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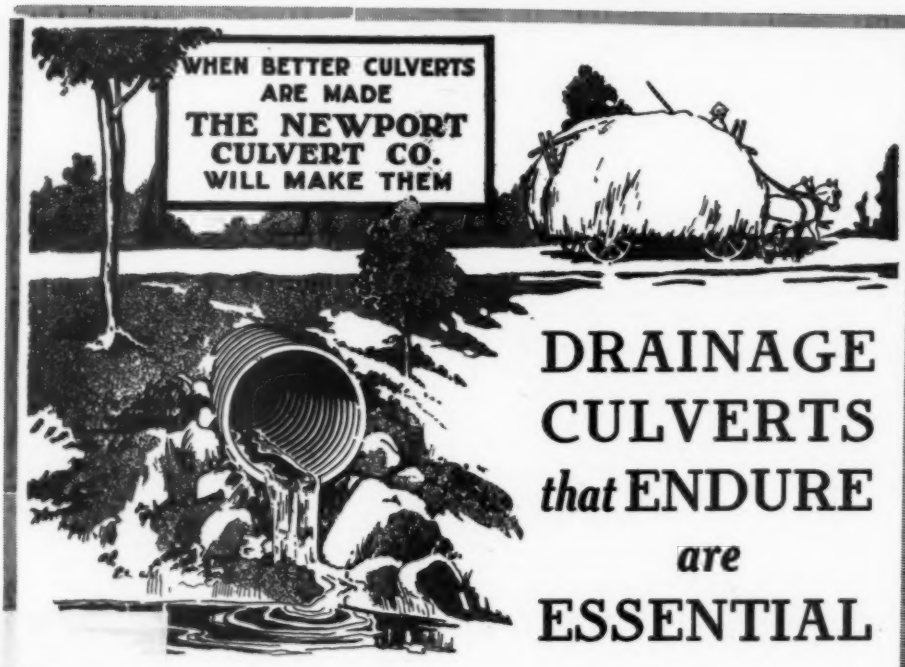

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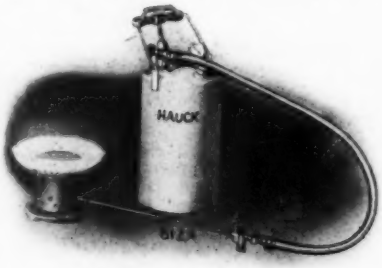

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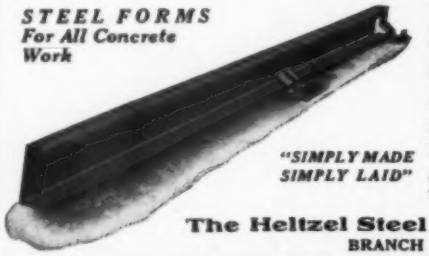

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Repair Your Streets with THE LUTZ SURFACE HEATER

It softens asphalt and other bituminous pavements. It vulcanizes the old and new material into a perfect bond. It cements Asphalt on Granite, Brick, Cobble, or other hard pavements. It makes re-surfacing and maintenance easy and inexpensive.

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The Ideal Method of Providing for Expansion in Improved Pavements

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for paving and sidewalk work

Used by progressive municipalities and contractors.
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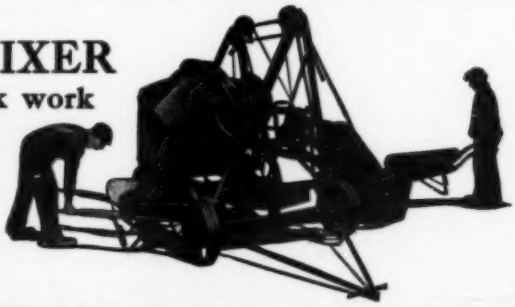

CHAINS
American Chain Co., Inc., Bridgeport, Conn.
Columbus McKinnon Chain Co., Columbus, O.
Niagara Metal Stamp. Corp., Niagara Falls, N. Y.
U. S. Chain & Forge Co., Pittsburgh, Pa.

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Chain Belt Co., Milwaukee, Wis.
Jeffrey Mfg. Co., Columbus, O.
Link-Belt Co., Chicago, Ill.
Webster Mfg. Co., Chicago, Ill.

CHECK VALVES
*Mueller Mfg. Co., H., Decatur, Ill.
Columbian Iron Works, Chattanooga, Tenn.
Ludlow Valve Mfg. Co., Troy, N. Y.
Lunkenheimer Co., Cincinnati, O.

CHEMICALS FOR WATER PURIFICATION
*Du Pont de Nemours & Co., E. I., Wilmington, Del.
*Mathieson Alkali Works, Inc., N. Y. C.
*Penna. Salt Mfg. Co., Philadelphia, Pa.
Electro Bleaching Gas Co., New York.
General Chemical Co., New York.

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Heine Chimney Co., Chicago, Ill.
Rust Engineering Co., Pittsburgh, Pa.
Weber Chimney Co., Chicago, Ill.

CHIMNEYS, RADIAL BRICK
*American Chimney Corp., New York City.
Kellogg & Co., M. W., New York.
Rust Engineering Co., Pittsburgh, Pa.
Weber Chimney Co., Chicago, Ill.

CHIMNEYS, STEEL (See Stacks, Steel)

CHLORINATORS
*Wallace & Tiernan Co., Inc., New York.

CHLORINE, LIQUID (See Liquid Chlorine)

CHUTES, CONCRETE
*Ransome Concrete Machy. Co., Dunellen, N. J.
Insley Mfg. Co. Indianapolis, Ind.
Lakewood Engineering Co., Cleveland, O.

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Carpenter Co., Geo. B., Chicago, Ill.
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Roebling Sons Co., J. A., Trenton, N. J.
Upson-Walton Co., Cleveland, O.

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*Fairfield Engineering Co., Lancaster, Ohio.
*Good Roads Mach'y Co., Philadelphia, Pa.
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Blaw-Knox Co., Pittsburgh, Pa.
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Byers Machine Co., J. F., Cleveland, O.
Chain Belt Co., Milwaukee, Wis.
Corrugated Bar Co., Inc., Buffalo, N. Y.
Gifford-Wood Co., Hudson, N. Y.
Haiss Mfg. Co., Geo., New York.
Hayward Co., New York.
Hunt Co., Inc., C. W., West New Brighton, N. Y.
Jeffrey Mfg. Co., Columbus, O.
Lidgerwood Mfg. Co., New York.
Link-Belt Co., Chicago, Ill.
Mead-Morrison Mfg. Co., E. Boston, Mass.
Portable Machinery Co., Passaic, N. J.
Robins Conveying Belt Co., New York.
Webster Mfg. Co., Chicago, Ill.

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*Mueller Mfg. Co., H., Decatur, Ill.
*Union Water Meter Co., Worcester, Mass.
Chapman Valve Mfg. Co., Indian Orchard, Mass
Glauber Brass Mfg. Co., Cleveland, O.
Haydenville Co., Haydenville, Mass.

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Blaw-Knox Co., Pittsburgh, Pa.
Hydraulic Steelcraft Co., Cleveland, O.
Insley Mfg. Co., Indianapolis, Ind.
Universal Form Clamp Co., Chicago, Ill.

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Anti-Hydro Waterproofing Co., New York
General Fireproofing Co., Youngstown, Ohio.
Granitex Corp., New York.
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Master Builders Co., Cleveland, O.
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*Jaeger Machine Co., Columbus, O.
*Koehring Machine Co., Milwaukee, Wis.
*Knickerbocker Co., Jackson, Mich.
*Ransome Concrete Machy. Co., Dunellen, N. J.
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Badger Concrete Mixer Co., Milwaukee, Wis.
Chain Belt Co., Milwaukee, Wis.
Construction Mach'y Co., Waterloo, Iowa.
Contractors' Equipment Co., Keokuk, Ia.
Foote Concrete Mchy. Co., Chicago, Ill.
Judy Mfg. Co., Centerville, Ia.
Lakewood Engineering Co., Cleveland, O.
Lansing Co., Lansing, Mich.
Oshkosh Mfg. Co., Oshkosh, Wis.
Schramm & Son, Inc., Chris D., Philadelphia, Pa.
Smith Co., T. L., Milwaukee, Wis.
Worthington Pump & Mach'y Corp., New York.

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Carnegie Steel Co., Pittsburgh, Pa.
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Consolidated Expanded Metal Co., Braddock, Pa.
Corrugated Bar Co., Inc., Buffalo, N. Y.
Electric Welding Co., Pittsburgh, Pa.
General Fireproofing Co., Youngstown, O.
Inland Steel Co., Chicago, Ill.
Lackawanna Steel Co., Buffalo, N. Y.
Ryerson & Son., J. T., Chicago, Ill.
Wickwire Spencer Steel Corp., Worcester, Mass.

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*Allis-Chalmers Mfg. Co., Milwaukee, Wis.
*Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.
Cameron Steam Pump Works, A. S., New York.
Dean Bros. Steam Pump Wks., Indianapolis, Ind.
Ingersoll-Rand Co., New York.
Wheeler Condenser & Eng. Co., Carteret, N. J.
Worthington Pump & Mach'y Corp., New York.

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Bissell Co., F., Toledo, Ohio.
Waldo Bros. & Bond Co., Boston, Mass.

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Fibre Conduit Co., Orangeburg, N. Y.
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National Fireproofing Co., New York.
National Metal Molding Co., Pittsburgh, Pa.
Youngstown Sheet & Tube Co., Youngstown, O.

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Dewey Supply Corp., New York.
Hyland Co., R. H., Chicago, Ill.
Shannon & Co., J. Jacob, Philadelphia, Pa.

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*Craven Co., Frank T., New York.
*Curtiss-Willis Co., New York.
*Forsythe Bros., New York.
*Grey Steel Prod. Co., New York.
*King, Philip T., New York, N. Y.
*Weiss, B. M., Philadelphia, Pa.
Contractors' Mach. & Supply Co., Pittsburgh, Pa.
Reading Engineering Co., New York.
Zelnicker Supply Co., Walter A., St. Louis, Mo.

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Barber-Greene Co., Aurora, Ill.
Gifford Wood Co., Hudson, N. Y.
Goodyear Tire & Rubber Co., Akron, O.
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Jeffrey Mfg. Co., Columbus, O.
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Republic Rubber Co., Youngstown, O.
Robins Conv. Belt Co., N. Y. C.
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** Indicates that the manufacturer carries an advertisement. See index facing inside back cover.*

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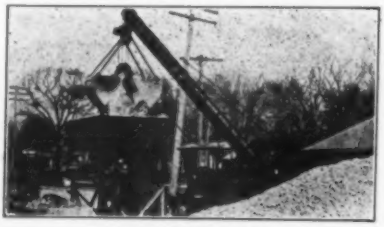

For any material handling job.
Oil engine operated. Any type of traction.
All steel Boom. Clam Shell dipper or hook.
The most substantially built and lowest priced Motor Crane of this type, a *convertible* loader, digger or derrick.

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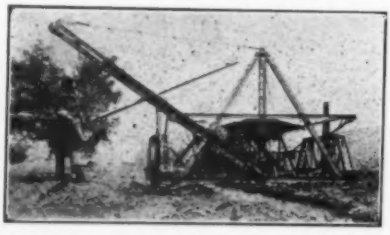

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Capacities: ½ to 1 Cubic Yard.
Spans the ditch.
Self propelling over rough or swampy ground.

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For Clay, Sand, or Gravel Pits or Road Contractors. ⅜ cubic yard capacity.

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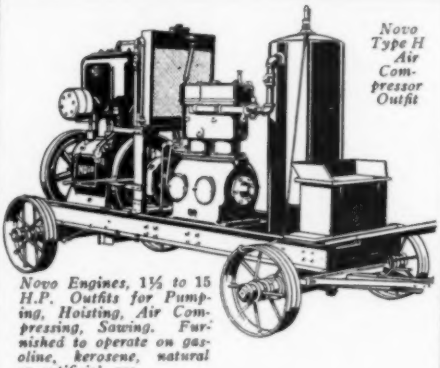

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Novo Engines, 1½ to 15 H.P. Outfits for Pumping, Hoisting, Air Compressing, Sawing. Furnished to operate on gasoline, kerosene, natural or artificial gas.

A Two-Foot Hole in Four Minutes

For rock drilling in road excavations a Novo Air Compressor Outfit will give real satisfaction. It'll carry full loads for long periods without overheating; it runs quietly, at a constant speed; it is mounted on a team truck for portability; it is hung low, so the engine can be started from the ground.

The No. 174 Outfit has a 6″ x 6″ duplex compressor operated by a 15 H.P. Novo Engine. It delivers air at a working pressure of 100 pounds—and enough air to drill a hole two feet deep in three or four minutes.

This is the largest of five Air Compressor Outfits, designed to meet the various needs of road-building contractors. For full information regarding these outfits, write for Novo Bulletin No. 152.

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New York Office: 1617 Woolworth Building
Chicago Office: 800 Old Colony Building
London Concrete Machinery Co., Limited, London, Ontario, Canadian Distributors

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*Weller Mfg. Co., Chicago, Ill.
Atlas Engineering Co., Milwaukee, Wis.
Bartlett & Snow Co., C. O., Cleveland, O.
Chain Belt Co., Milwaukee, Wis.
Gifford Wood Co., Hudson, N. Y.
Godfrey Conveyor Co., Elkhart, Ind.
Guarantee Constn. Co., New York.
Haiss Mfg. Co., Geo., New York.
Jeffrey Mfg. Co., Columbus, O.
Link-Belt Co., Chicago, Ill.
Mead-Morrison Mfg. Co., E. Boston, Mass.
Republic Rubber Co., Youngstown, O.
Robins Conv. Belt Co., N. Y. C.
Russell Grader Mfg. Co., Minneapolis, Minn.
Webster Mfg. Co., Chicago, Ill.

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Standard Conveyor Co., No. St. Paul, Minn.
Mathews Gravity Carrier Co., Ellwood City, Pa.

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*Bucyrus Co., South Milwaukee, Wis.
*Marion Steam Shovel Co., Marion, O.
*Pawling & Harnischfeger Co., Milwaukee, Wis.
*Thew Shovel Co., Lorain, O.
American Hoist & Derrick Co., St. Paul, Minn.
Brown Hoisting Mchy. Co., Cleveland, O.
Browning Co., Cleveland, O.
Davenport Locomotive Works, Davenport, Ia.
Hanna Eng. Works, Chicago, Ill.
Industrial Works, Bay City, Mich.
Link-Belt Co., Chicago, Ill.
Locomotive Crane Co. of America, Chicago, Ill.
McMyler Interstate Co., Cleveland, O.
Northwest Engineering Works, Chicago, Ill.
Orton & Steinbrenner Co., Chicago, Ill.
Ohio Locomotive Crane Co., Bucyrus, O.
Osgood Co., The, Marion, O.
Overland Crane Co., Hammond, Ind.
U. S. Crane Co., Chicago, Ill.

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*Pawling & Harnischfeger Co., Milwaukee, Wis.
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Chesapeake Iron Works, Baltimore, Md.
Hanna Eng. Works, Chicago, Ill.
Link-Belt Co., Chicago, Ill.
Northern Eng. Works, Detroit, Mich.
Speidel, J. G., Reading, Pa.
Terry Mfg. Co., Edw. F., N. Y. C.
Toledo Crane Co., Toledo, Ohio.
U. S. Crane Co., Chicago, Ill.
Whiting Corp'n, Harvey, Ill.

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Browning Co., Cleveland, O.
Industrial Works, Bay City, Mich.
U. S. Crane Co., Chicago, Ill.

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American Creosoting Co., N. Y. C.
American Creosote Works, Inc., N. Orleans, La.
Jennison-Wright Co., Toledo, O.
Southern Paving Constr. Co., Chattanooga, Tenn.
Southern Wood Pres. Co., Atlanta, Ga.
Wyckoff Pipe & Creosoting Co., New York.

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Jennison-Wright Co., Toledo, O.
Southern Creosoting Co., Ltd., Slidell, La.
Southern Paving Const. Co., Chattanooga, Tenn.
Wyckoff Pipe & Creosoting Co., New York.

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*Good Roads Machinery Co., Philadelphia, Pa.
*Newport Culvert Co., Newport, Ky.
*Truscon Steel Co., Youngstown, O.
*U. S. C. I. Pipe & Fdry. Co., Burlington, N. J.
American Cast Iron Pipe Co., Birmingham, Ala.
American Rolling Mill Co., Middletown, O.
Berger Mfg. Co., Canton, O.
Canton Culvert & Silo Co., Canton, O.
Dee Co., W. E., Chicago, Ill.
Edwards Mfg. Co., Cincinnati, O.
Galion Iron Works & Mfg. Co., Galion, O.
Hardesty Mfg. Co., The R., Denver, Colo.
Lyle Culv. & Rd. Equip. Co., Minneapolis, Minn.
Madison Foundry Co., Cleveland, O.
Russell Grader Mfg. Co., Minneapolis, Minn.
Southern Metal Culvert Co., Salisbury, N. C.
Wheeling Corrugating Co., Wheeling, W. Va.
Wood & Co., R. D., Philadelphia, Pa.

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Casey-Hedges Co., Chattanooga, Tenn.
Clark Co., H. W., Mattoon, Ill.
Clow & Sons, J. B., Chicago, Ill.
Madison Foundry Co., Cleveland, O.
S. E. T. Valve & Hydrant Co., N. Y. C.
Thompson-Flemming Co., Inc., Buffalo, N. Y.

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*Truscon Steel Co., Youngstown, O.
Concrete Steel Co., New York.
National Steel Fabric Co., Pittsburgh, Pa.
Steel Protected Concrete Co., Philadelphia, Pa.

CUTTERS, PIPE, HAND
*Crane Co., Chicago, Ill.
*Smith Mfg. Co., A. P., East Orange, N. J.
Armstrong Mfg. Co., Bridgeport, Conn.
Barnes Tool Co., New Haven, Conn.
Erie Tool Works, Erie, Pa.
Greenfield Tap & Die Corp'n., Greenfield, Mass.
Walworth Mfg. Co., Boston, Mass.

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*Koehring Machine Co., Milwaukee, Wis.
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Helwig Mfg. Co., St. Paul, Minn.
Worthington Pump & Mchy. Corp., New York.

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Milburn Co., Alexander, Baltimore, Md.
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Dobbie Fdry. & Mach. Co., Niagara Falls, N. Y.
Federal Bridge & Struc. Co., Waukesha, Wis.
Flory Mfg. Co., S., Bangor, Pa.
Insley Mfg. Co., Indianapolis, Ind.
Lakeside Bridge & Steel Co., N. Milwaukee, Wis.
Lidgerwood Manufacturing Co., New York.
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Smith, Whitcomb & Cook Co., Barrie, Vt.
Superior Iron Works, Superior, Wis.
Terry Mfg. Co., Edw. F., New York.

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Austin Machinery Corp'n, Chicago, Ill.
Clyde Iron Works, Duluth, Minn.
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Federal Bridge & Struc. Co., Waukesha, Wis.
Hayward Co., New York.
Insley Mfg. Co., Indianapolis, Ind.
Lakeside Bridge & Steel Co., N. Milwaukee, Wis.
Lidgerwood Manufacturing Co., New York.
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Terry Mfg. Co., Edw. F., New York.

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Dobbie Fdry. & Mach. Co., Niagara Falls, N. Y.
Lidgerwood Manufacturing Co., New York.
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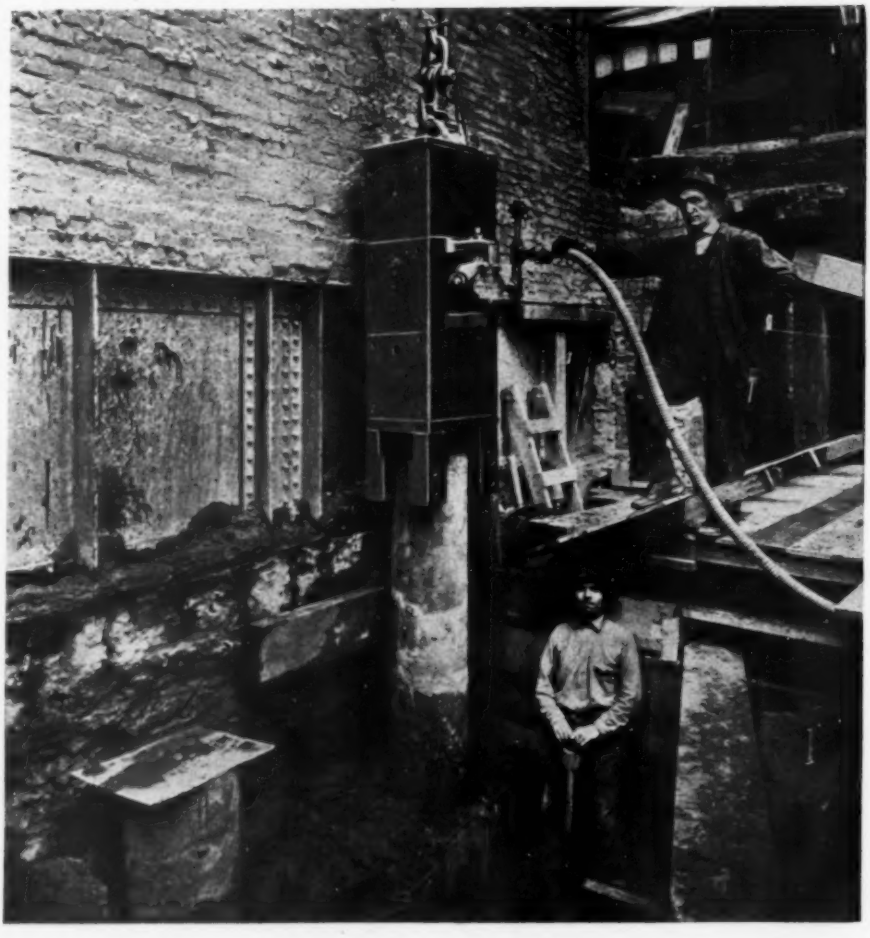
Clyde Iron Works, Duluth, Minn.
Dobbie Fdry. & Mach. Co., Niagara Falls, N. Y.
Hayward Co., New York.
Hoisting Engine Sales Co., New York.
Orton & Steinbrenner Co., Chicago, Ill.
Terry Mfg. Co., Edward F., New York.



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Rock Drills—Pile Hammers—Lifting Jacks
Mining and Quarrying Machinery

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Insley Mfg. Co., Indianapolis, Ind.
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Spaulding-Moss Co., Boston, Mass.
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Hayward Co., New York.
Lidgerwood Mfg. Co., New York.
Osgood Co., The, Marion, O.
Stockton Iron Works, Stockton, Cal.
Superior Iron Works, Superior, Wis.
Vulcan Iron Works, Jersey City, N. J.

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*Bucyrus Co., South Milwaukee, Wis.
*Marion Steam Shovel Co., Marion, O.
American Steel Dredge Co., Fort Wayne, Ind.
Austin Machinery Corp'n, Chicago, Ill.
Fairbanks Steam Shovel Co., Marion, O.
Osgood Co., Marion, O.

DREDGES, HYDRAULIC
*Bucyrus Co., South Milwaukee, Wis.
*Marion Steam Shovel Co., Marion, O.
Ellicott Mach. Corp., Baltimore, Md.
Fairbanks Steam Shovel Co., Marion, O.
Morris Machine Works, Baldwinsville, N. Y.

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*McKiernan-Terry Drill Co., New York.
Chicago Pneumatic Tool Co., New York.
Cleveland Pneumatic Tool Co., Cleveland, O.
Cleveland Rock Drill Co., Cleveland, Ohio.
Helwig Mfg. Co., St. Paul, Minn.
Independent Pneumatic Tool Co., Chicago, Ill.
Ingersoll-Rand Co., New York.
Sullivan Machinery Co., Chicago, Ill.

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Ingersoll-Rand Co., New York.
Standard Diamond Drill Co., Chicago, Ill.

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*McKiernan-Terry Drill Co., New York.
Chicago Pneumatic Tool Co., New York.
Cleveland Pneumatic Tool Co., Cleveland, O.
Helwig Mfg. Co., St. Paul, Minn.
Ingersoll-Rand Co., New York.
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*Denver Rock Drill Mfg. Co., Denver, Colo.
*McKiernan-Terry Drill Co., New York.
Chicago Pneumatic Tool Co., New York.
Cleveland Rock Drill Co., Cleveland, Ohio.
Helwig Mfg. Co., St. Paul, Minn.
Ingersoll-Rand Co., New York.
Sullivan Machinery Co., Chicago, Ill.
Wood Drill Works, Paterson, N. J.

DRILLS FOR WELLS AND BLAST HOLES (See Well Drilling Machinery)

DRUMS, HOLDING
Blaw-Knox Co., Pittsburgh, Pa.
Clyde Iron Works, Duluth, Minn.
Dobbie Fdry. & Mach. Co., Niagara Falls, N. Y.
Hayward Co., New York.
Monighan Machine Co., Chicago, Ill.

DRYERS, ASPHALT AND CEMENT
*Allis-Chalmers Co., Milwaukee, Wis.
American Blower Co., Detroit, Mich.
American Process Co., New York.
Atlas Dryer Co., Cleveland, O.
Bartlett & Snow Co., C. O., Cleveland, O.
Cummer & Son Co., F. D., Cleveland, O.
East Iron & Machine Co., Lima, O.
Ruggles-Coles Eng. Co., New York.
Variety Iron & Steel Works, Cleveland, O.

DUMP BODIES FOR MOTOR TRUCKS
*Heil Company, Milwaukee, Wis.
*Littleford Bros., Cincinnati, O.
American Truck Body Co., Inc., Martinsville, Va.
Archer Iron Works, Chicago, Ill.
Auto Truck Steel Body Co., Chicago, Ill.
Columbian Steel Tank Co., Kansas City, Mo.
Horizontal Hydraulic Hoist Co., Milwaukee, Wis.
Lee Trailer & Body Co., Chicago, Ill.
Pechstein Iron Works, Keokuk, Iowa.
Simplex Mfg. Co., Conneautville, Pa.
Van Dorn Iron Wks., Cleveland, Ohio.
Wood Hydraulic Hoist & Body Co., Detroit, Mich.

DUMP CARTS AND WAGONS
*Acme Road Machinery Co., Frankfort, N. Y.
*Austin Western Road Mchy. Co., Chicago, Ill.
*Russell Grader Mfg. Co., Minneapolis, Minn.
*Tiffin Wagon Co., Tiffin, Ohio.
Acme Wagon Co., Emigsville, Pa.
Arcadia Trailer Corp., Newark, N. Y.
Austin Mfg. Co., Chicago, Ill.
Eagle Wagon Works, Auburn, N. Y.
Holsbog & Bro., Geo. H., Jeffersonville, Ind.
Stroud & Co., Omaha, Nebr.
Watson Products Corp., Canastota, N. Y.

DUST LAYING COMPOUNDS
*Barrett Co., New York.
*Dow Chemical Co., Midland, Mich.
*Standard Oil Co. of Indiana, Chicago, Ill.
*Texas Co., New York City.
Dustoline for Roads Co., Summit, N. J.
Semet-Solvay Co., Solvay, N. Y.

DYNAMITE (See Explosives)

EJECTORS, SEWAGE
Pacific Flush Tank Co., Chicago, Ill.
Yeomans Bros. Co., Chicago, Ill.

ELECTRIC GENERATORS AND MOTORS
*Allis-Chalmers Mfg. Co., Milwaukee, Wis.
*Fairbanks, Morse & Co., Chicago, Ill.
*General Electric Co., Schenectady, N. Y.
*Westinghouse Elec. & Mfg. Co., E. Pittsb'gh, Pa.
Ideal Elec. & Mfg. Co., Mansfield, O.
Triumph Electric Co., Cincinnati, O.
Western Electric Co., New York.

ELECTRIC LAMPS
*General Electric Co., Schenectady, N. Y.
*Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.

ELECTRIC LIGHTING PLANTS
*Allis-Chalmers Mfg. Co., Milwaukee, Wis.
*Fairbanks, Morse & Co., Chicago, Ill.
*General Electric Co., Schenectady, N. Y.
*Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.
Western Electric Co., New York

** Indicates that the manufacturer carries an advertisement. See index facing inside back cover.*

Coming Events Cast Their Shadows

Mother Earth fairly trembles at sight of the buckets with their sharpened steel teeth ready to bite a deep trench at the will of the one operator who controls this earth-eating monster.

Big, though it is, every part is carefully and thoroughly made. Every steel plate and girder is rolled before riveting,—one reason for its resistance to side strains. In action or idle it is a machine that the engineer is glad to inspect.

And close inspection reveals the reasons for the greater digging capacity and the low maintenance costs. It also shows why the initial cost is more, and why it is the lowest in cost for a given period of years.

Bulletin IX describes wheel type excavators as well as the latest ladder type illustrated above. Write for a copy today.

PAWLING & HARNISCHFEGER CO.

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Philadelphia: Stephen Girard Bldg.
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Chicago: Monadnock Block
New Orleans: Whitney Central Bldg.
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Los Angeles: Central Bldg.
Seattle: L. C. Smith Bldg.
Portland: Yeon Bldg.
Birmingham: C. B. Davis Eng. Co.
St. Louis: Blackman-Hill-McKee Machinery Co.
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Bissell Co., F., Toledo, Ohio.

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*Allis-Chalmers Mfg. Co., Milwaukee, Wis.
*General Electric Co., Schenectady, New York.
*Westinghouse Elec. & Mfg. Co., E. Pittsb'gh, Pa.
Kuhlman Electric Co., Bay City, Mich.

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*Austin Western Road Machy. Co., Chicago, Ill.
*Fairfield Engineering Co., Lancaster, Ohio.
*Good Roads Mach'y Co., Philadelphia, Pa.
*Littleford Bros., Cincinnati, Ohio.
*Russell Grader Mfg. Co., Minneapolis, Minn.
*Weller Mfg. Co., Chicago, Ill.
Atlas Eng. Co., Milwaukee, Wis.
Bartlett & Snow Co., C. O., Cleveland, Ohio.
Chain Belt Co., Milwaukee, Wis.
Gifford-Wood Co., Hudson, N. Y.
Haiss Mfg. Co., Geo., New York.
Jeffrey Mfg. Co., Columbus, O.
Link-Belt Co., Chicago, Ill.
Robins Conv. Belt Co., N. Y. C.
Webster Mfg. Co., Chicago, Ill.
Worthington Pump & Mchy. Corp., New York.

ELEVATORS, CONTRACTING MATERIAL
*Fairfield Engineering Co., Lancaster, Ohio.
*Ransome Concrete Machy. Co., Dunellen, N. J.
American Hoist & Derrick Co., St. Paul, Minn.
Byers Machine Co., J. F., Ravenna, O.
C. H. & E. Mfg. Co., Milwaukee, Wis.
Insley Mfg. Co., Indianapolis, Ind.

ELEVATORS, FACTORY
Otis Elevator Co., New York.
Ridgway & Son Co., C., Coatesville, Pa.
Speidel, J. G., Reading, Pa.
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*Allis-Chalmers Mfg. Co., Milwaukee, Wis.
*Fairbanks, Morse & Co., Chicago, Ill.
*Holt Mfg. Co., Peoria, Ill.
*Novo Engine Co., Lansing, Mich.
*Standard Scale & Supply Co., Pittsburgh, Pa.
C. H. & E. Mfg. Co., Milwaukee, Wis.
Chicago Pneumatic Tool Co., New York.
Domestic Engine & Pump Co., Shippensburg, Pa.
Foos Gas Engine Co., Springfield, Ohio.
Gade Bros. Mfg. Co., Iowa Falls, Iowa.
"New-Way" Motor Co., Lansing, Mich.
Universal Motor Co., Oshkosh, Wis.
Weber Engine Co., Kansas City, Mo.
Worthington Pump & Mchy. Corp., New York.

ENGINES, HIGH DUTY WATER-WORKS
*Allis-Chalmers Mfg. Co., Milwaukee, Wis.
*De Laval Steam Turbine Co., Trenton, N. J.
*Fairbanks, Morse & Co., Chicago, Ill.
Morris Machine Works, Baldwinsville, N. Y.
Murray Iron Works Co., Burlington, Ia.
Worthington Pump & Mchy. Corp., New York.

ENGINES, OIL
*Allis-Chalmers Mfg. Co., Milwaukee, Wis.
*Bush-Sulzer Bros.-Diesel Eng. Co., St. Louis, Mo.
*Fairbanks, Morse & Co., Chicago, Ill.
*Nordberg Mfg. Co., Milwaukee, Wis.
*Pittsburgh Filter & Eng. Co., Pittsburgh, Pa.
*Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.
Advance Rumely Thresher Co., La Porte, Ind.
Bessemer Gas Eng. Co., Grove City, Pa.
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Foos Gas Engine Co., Springfield, O.
Ingersoll-Rand Co., New York.
International Harvester Co. of Am., Chicago, Ill.
Machinery Sales Co., Chicago, Ill.
Midwest Engine Co., Indianapolis, Ind.
Weber Engine Co., Kansas City, Mo.
Worthington Pump & Mchy. Corp., New York.

ENGINES, PUMPING
*Allis-Chalmers Mfg. Co., Milwaukee, Wis.
*American Well Works, Aurora, Ill.
*Dayton-Dowd Co., Quincy, Ill.
*Fairbanks Morse & Co., Chicago, Ill.
*Nordberg Mfg. Co., Milwaukee, Wis.
*Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.
American Gas Engine Co., Kansas City, Mo.
Deming Co., Salem, O.
Enterprise Mchy. Co., Minneapolis, Minn.
Midwest Engine Co., Indianapolis, Ind.
United Iron Works, Inc., Kansas City, Mo.
Weinman Pump Mfg. Co., Columbus, O.
Worthington Pump & Mchy. Corp., New York.

ENGINES, STEAM
*Allis-Chalmers Mfg. Co., Milwaukee, Wis.
*Nordberg Mfg. Co., Milwaukee, Wis.
Ball Engine Co., Erie, Pa.
Dake Engine Co., Grand Haven, Mich.
Erie Pump & Engine Co., Medina, N. Y.
Filer-Stowell Co., Milwaukee, Wis.
Hardie-Tynes Mfg. Co., Birmingham, Ala.
Leffel Co., J., Springfield, O.
Morris Machine Works, Baldwinsville, N. Y.
Murray Iron Works Co., Burlington, Ia.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.
Vilter Mfg. Co., Milwaukee, Wis.

ENGINES, TRACTION
*Austin-Western Road Mchy. Co., Chicago, Ill.
*Fairbanks, Morse & Co., Chicago, Ill.
*Holt Mfg. Co., Peoria, Ill.
Oliver Tractor Co., Knoxville, Tenn.
Phoenix Mfg. Co., Eau Claire, Wis.

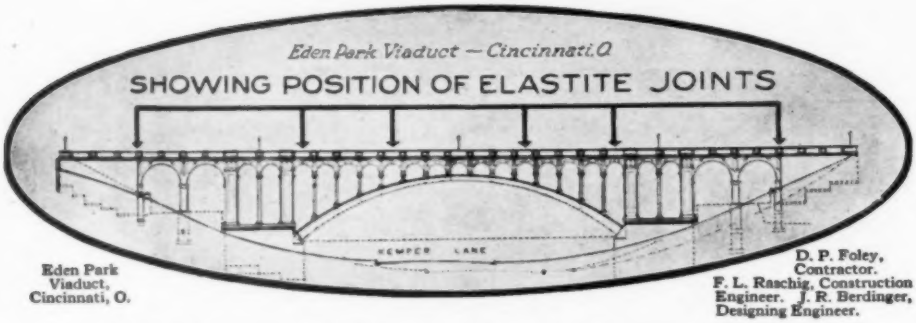
EXCAVATING MACHINERY. (See Names Under Excavators, also Steam Shovels)

EXCAVATORS, CABLEWAY
*Bucyrus Co., South Milwaukee, Wis.
*Marion Steam Shovel Co., Marion, O.
Ball Eng. Co., Erie, Pa.
Blaw-Knox Co., Pittsburgh, Pa.
Byers Machine Co., J. F., Ravenna, O.
Ledgerwood Mfg. Co., New York.
Smith Co., T. L., Milwaukee, Wis.

EXCAVATORS, DITCH AND TRENCH
*Baker Mfg. Co., Springfield, Ill.
*Bay City Dredge Works, Bay City, Mich.
*Bucyrus Co., South Milwaukee, Wis.
*Marion Steam Shovel Co., Marion, O.
*Pawling & Harnischfeger Co., Milwaukee, Wis.
*Russell Grader Mfg. Co., Minneapolis, Minn.
American Hoist & Derrick Co., St. Paul, Minn.
Austin Machinery Corp'n, Chicago, Ill.
Ball Engine Co., Erie, Pa.
Buckeye Traction Ditcher Co., Findlay, O.
Byers Machine Co., J. F., Ravenna, O.
Clyde Iron Works, Duluth, Minn.
Economy Excavator Co., Iowa Falls, Ia.
Fairbanks Steam Shovel Co., Marion, O.
Hayward Co., The, New York City.
Keystone Driller Co., Beaver Falls, Pa.
Monighan Machine Co., Chicago, Ill.
Osgood Co., Marion, O.
Parsons Co., Newton, Ia.

EXCAVATORS, DRAG-LINE
*Bucyrus Co., South Milwaukee, Wis.
*Marion Steam Shovel Co., Marion, O.
*Pawling & Harnischfeger Co., Milwaukee, Wis.
Austin Machinery Corp'n, Chicago, Ill.
Browning Co., Cleveland, O.
Byers Machine Co., J. F., Ravenna, O.
Clyde Iron Works, Duluth, Minn.
Economy Excavator Co., Iowa Falls, Ia.
Gade, C. L., Iowa Falls, Iowa.
Hayward Co., New York.
Industrial Works, Bay City, Mich.
Link-Belt Co., Chicago, Ill.
Monighan Machine Co., Chicago, Ill.
Osgood Co., Marion, O.
Parsons Co., Newton, Ia.
Smith Co., T. L., Milwaukee, Wis.

EXPANDED METAL
*Truscon Steel Co., Youngstown, O.
Berger Mfg. Co., Canton, O.
Consolidated Expanded Metal Co., Braddock, Pa.
Corrugated Bar Co., Inc., Buffalo, N. Y.
Northwestern Expanded Metal Co., Chicago, Ill.



Eden Park Viaduct, Cincinnati, O.

D. P. Foley, Contractor. F. L. Raschig, Construction Engineer. J. R. Berdinger, Designing Engineer.

A RISE from zero to 100 degrees Fahrenheit will cause an expansion of 2 inches.

A drop from 100 degrees Fahrenheit to zero will cause a contraction of two inches in a viaduct of this length and will open a two-inch crack or its equivalent in small cracks.

The engineers who built this structure installed Carey Elastite at six intervals.

It is four years old and crackless, and it will be crackless at forty—because Elastite remains elastic in all kinds of weather year after year and functions perfectly as a safety valve.

More engineers adopt this safety first product every year for reasons which will appeal to you.

The Archibald W. Butt Memorial Bridge, Augusta, Ga.; Galveston Causeway, Galveston, Texas; Yale Bowl, New Haven, Conn.; Fordson Tractor Plant retaining wall Hamilton, Ohio, are some of the structures on which it is used.

Write for full particulars and sample

THE PHILIP CAREY COMPANY

9-Wayne Avenue, Lockland, Cincinnati, Ohio

Carey Elastite

Reg. U.S. Patent Office

EXPANSION JOINT

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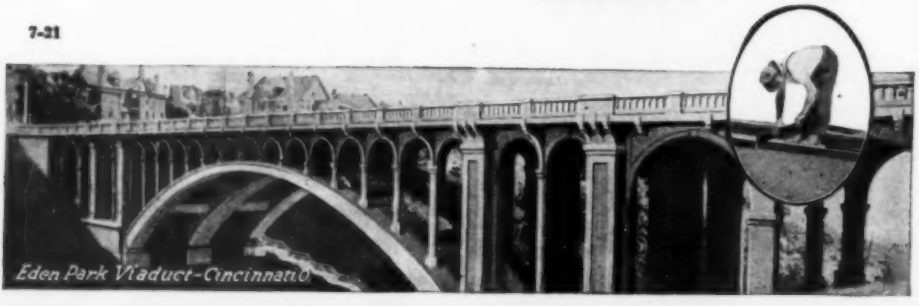


EXPANSION JOINT MATERIAL
*Barber Asphalt Paving Co., Philadelphia, Pa.
*Barrett Co., New York.
*Carey Co., Philip, Cincinnati, Ohio.
*Pioneer Asphalt Co., Lawrenceville, Ill.
*Texas Company, New York.
*Truscon Steel Co., Youngstown, O.
*Waring-Underwood Co., Philadelphia, Pa.

EXPLOSIVES
*Du Pont de Nemours & Co., E. I., Wilmington, Del.
Atlas Powder Co., Wilmington, Del.
Giant Powder Co., Cons., San Francisco, Cal.
Hercules Powder Co., Wilmington, Del.

FENCING
American Steel & Wire Co., Chicago, Ill.
Anchor Post Iron Works, New York.
Cyclone Fence Co., Waukegan, Ill.
Frost-Superior Fence Co., Cleveland, O.
Indiana Steel & Wire Co., Muncie, Ind.
Kitselman Bros., Muncie, Ind.
Pittsburgh Steel Co., Pittsburgh, Pa.
Stewart Iron Works Co., Cincinnati, Ohio.
Texas Cyclone Fence Co., Fort Worth, Tex.
Wickwire Spencer Steel Corp'n, Worcester, Mass.

FILING EQUIPMENT, STEEL
Art Metal Constr. Co., Jamestown, N. Y.
Berger Mfg. Co., Canton, O.
Econ. Drawing Table & Mfg. Co., Adrian, Mich.
Van Dorn Iron Works, Cleveland, O.

FILTERS, OIL
Bowser & Co., Inc., S. F., Fort Wayne, Ind.
Wayne Oil Tank & Pump Co., Ft. Wayne, Ind.

FILTERS, WATER
*Norwood Engineering Co., Florence, Mass.
*Pittsburgh Filter & Eng. Co., Pittsburgh, Pa.
American Water Softener Co., Philadelphia, Pa.
Hygeia Filter Co., Detroit, Mich.
International Filter Co., Chicago, Ill.
N. Y. Continental Jewel Filtr. Co., Nutley, N. J.
Roberts Filter Co., Darby, Pa.
Scaife & Sons Co., W. B., Pittsburgh, Pa.

FIRE EXTINGUISHERS, CHEMICAL
American-La France Fire Eng. Co., Elmira, N. Y.
Childs Co., O. J., Utica, N. Y.
Cross Mfg. Co., C. J., Inc., New York.
Foamite Firefoam Co., New York.
Pyrene Mfg. Co., New York.

FIREPROOF BUILDING MATERIAL
*Delaware Clay Products Co., Pittsburgh, Pa.
*Truscon Steel Co., Youngstown, O.
Berger Mfg. Co., Canton, O.
Corrugated Bar Co., Inc., Buffalo, N. Y.
Detroit Steel Prod. Co., Detroit, Mich.
General Fireproofing Co., Youngstown, O.
Keasbey & Mattison Co., Ambler, Pa.
Kinnear Mfg. Co., Columbus, O.
National Fireproofing Co., Pittsburgh, Pa.
United States Gypsum Co., Chicago, Ill.

FIRST AID EQUIPMENT
American-La France Fire Eng. Co., Elmira, N. Y.

FLEXIBLE JOINTS
*Central Foundry Co., New York.
*Crane Co., Chicago, Ill.
*United Lead Company, New York.
*U. S. C. I. Pipe & Fdry Co., Burlington, N. J.
Coldwell-Wilcox Co., Newburgh, N. Y.
Lunkenheimer Co., Cincinnati, O.

FLOORS, WOOD BLOCK
*Barrett Co., New York.
Jennison-Wright Co., Toledo, O.
Republic Creosoting Co., Indianapolis, Ind.
Southern Wood Pres. Co., Atlanta, Ga.

FLUSH TANKS
*Pacific Flush Tank Co., Chicago, Ill.

FLUSHERS, STREET
*Kinney Mfg. Co., Boston, Mass.
*Municipal Supply Co., South Bend, Ind.
*Tiffin Wagon Co., Tiffin, O.
Etnyre, E. D., & Co., Oregon, Ill.

FORGES
*Hauck Mfg. Co., Brooklyn, N. Y.
Buffalo Forge Co., Buffalo, N. Y.

FORM CLAMPS
Insley Mfg. Co., Indianapolis, Ind.
Marion Malleable Iron Works, Marion, Ind.
Universal Form Clamp Co., Chicago, Ill.

FORMS, CONSTRUCTION
*Connery & Co., Philadelphia, Pa.
*Heltzel Steel Form & Iron Co., Warren, O.
*Truscon Steel Co., Youngstown, O.
Blaw-Knox Co., Pittsburgh, Pa.
Hydraulic Steelcraft Co., Cleveland, O.
Metal Forms Corp., Milwaukee, Wis.

FURNITURE AND FILES, STEEL
Art Metal Constn. Co., Jamestown, N. Y.
General Fireproofing Co., Youngstown, O.
Van Dorn Iron Works, Cleveland, O.

GARBAGE DISPOSAL
Bartlett & Snow Co., C. O., Cleveland, O.
Cummer & Son Co., F. D., Cleveland, O.
Decarie Incinerator Co., Minneapolis, Minn.
Destructor Co., New York.
Jeffrey Manufacturing Co., Columbus, O.
Morse-Boulger Destructor Co., New York.
Nye Odorless Crematory Co., Macon, Ga.

GARBAGE TRUCKS
*Austin Western Road Mchy. Co., Chicago, Ill.
*Federal Motor Truck Co., Detroit, Mich.
*Tiffin Wagon Co., Tiffin, O.
*White Co., Cleveland, O.
Autocar Co., Ardmore, Pa.
Four Wheel Drive Auto Co., Clintonville, Wis.
Holzbog & Bro., Geo. H., Jeffersonville, Ind.
Lee Trailer & Body Co., Chicago, Ill.
Service Motor Truck Co., Wabash, Ind.
Watson Products Corp., Canastota, N. Y.

GAS ENGINES. **(See Engines, Gas and Gasoline.)**

GAS METERS
*Builders Iron Foundry, Providence, R. I.
*General Electric Co., Schenectady, New York.
*Pittsburg Meter Co., East Pittsburgh, Pa.

GAS PRODUCERS
*Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.
Camden Iron Works, Camden, N. J.

GASOLINE PUMPING ENGINES
*Allis-Chalmers Mfg. Co., Milwaukee, Wis.
*American Well Works, Aurora, Ill.
*Fairbanks, Morse & Co., Chicago, Ill.
*Waldo Bros. & Bond Co., Boston, Mass.
Worthington Pump & Mchy. Corp., New York.

GASOLINE STORAGE TANKS
*Heil Co., Milwaukee, Wis.
*Honhorst Co., Jos., Cincinnati, Ohio.
*Littleford Bros., Cincinnati, O.
Biggs Boiler Works, Akron, Ohio.
Bowser & Co., Inc., S. F., Fort Wayne, Ind.
Byers Mach. Co., J. F., Ravenna, Ohio.
Chicago Bridge & Iron Works, Chicago, Ill.
Scaife & Sons, Wm. B., Oakmont, Pa.
United Iron Works, Kansas City, Mo.
Wayne Oil Tank & Pump Co., Ft. Wayne, Ind.

GATES, SLUICE
*Crane Co., Chicago, Ill.
Chapman Valve Mfg. Co., Indian Orchard, Mass.
Coffin Valve Co., Boston, Mass.
Coldwell-Wilcox Co., Newburgh, N. Y.
Columbian Iron Works, Chattanooga, Tenn.
Eddy Valve Co., Waterford, N. Y.
Hardesty Mfg. Co., Inc., Denver, Col.
Kennedy Valve Mfg. Co., Elmira, N. Y.
Ludlow Valve Mfg. Co., Troy, N. Y.
Rensselaer Valve Co., Troy, N. Y.
Wood & Co., R. D., Philadelphia, Pa.

GAUGES, RECORDING, PRESSURE, STEAM
Bristol Co., Waterbury, Conn.
Crosby Steam Gauge & Valve Co., Boston, Mass.
Marsh & Co., Jas. P., Chicago, Ill.
Schaeffer & Budenberg Mfg. Co., Brooklyn, N. Y.
U. S. Gauge Co., New York.

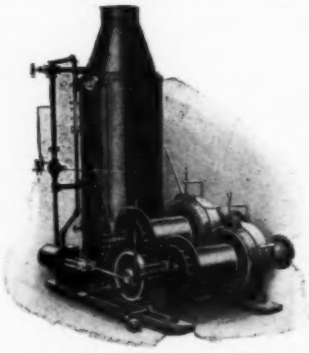
** Indicates that the manufacturer carries an advertisement.* *See index facing inside back cover*

There Are Unusual Features In All NATIONAL Equipment

National Pile and Sheeting Hammers deliver between 150 and 400 powerful blows per minute depending upon size. They are accelerated by steam air ASSISTED BY GRAVITY, a combination resulting in the fastest possible driving. They are of open face construction permitting quick and easy lubrication or adjustment of all working parts without pulling down the hammer. These hammers may be inverted and used for pulling where it is desired to salvage the sheeting. Made in seven sizes to meet every requirement.

National Hoists are of the most modern design and unexcelled workmanship. Made in one, two and three drum types, equipped with or without swinger, winch heads, etc. Furnished in steam, gasolene, gas and electric power. All hoists made by duplicate part system assuring positive interchangeability of parts.

Complete details upon request.



National Hoisting Engine Co.

Office and Works

Harrison New Jersey

NATIONAL

WOLVERINE MIXERS

A Knickerbocker Product

¶ The Wolverine Concrete Mixers successfully fill a big need right now, both in the building field and in the construction of sidewalks, bridges and culverts, for a well made, low priced mixer.

¶ The special design of these mixers, together with the quantity built, permits us to make them the desired weight for portability, and of sufficient strength to withstand the hard work they are subjected to on the job, and still sell them at exceedingly low prices.

THE KNICKERBOCKER CO., 236 Liberty St., JACKSON, MICH., U. S. A.

Knickerbocker Line of Concrete Mixers, Mortar Mixers, Portable Saw Rigs

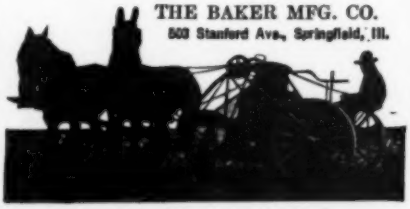
BAKER MANEY Self-Loading SCRAPERS

They dig, load, haul, dump and spread

Write to

THE BAKER MFG. CO.

503 Stanford Ave., Springfield, Ill.



Everything in Reinforcement for Concrete Roads

Truscon Wire Mesh, furnished in flat sheets cut to length, is a superior reinforcement especially made for concrete highways.

Truscon Road Mesh is an expanded metal with 6" x 12" diamond mesh; furnished in flat sheets 5ft. wide and various lengths.

Truscon Curb Bars protect and reinforce the concrete curbs. Positive anchorage; easy to handle and install.

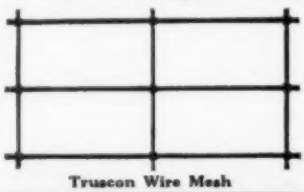
TRUSCON STEEL COMPANY

Youngstown, Ohio

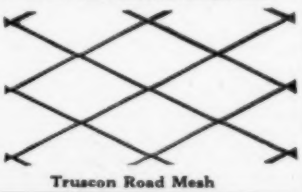
Warehouses and Sales Offices in Principal Cities

TRUSCON STEEL CO. TRUSCON BUILDING PRODUCTS

Truscon Curb Bars



Truscon Wire Mesh



Truscon Road Mesh

GAUGES, WATER
Ashton Valve Co., Boston, Mass.
Bristol Co., Waterbury, Conn.
Clow & Sons, J. B., Chicago, Ill.
Lunkenheimer Co., Cincinnati, O.
United States Gauge Co., New York.
Walworth Mfg. Co., Boston, Mass.

GAUGES, SURFACE, RESERVOIR AND SPECIAL WATER-WORKS
*Builders Iron Foundry, Providence, R. I.
Clark Co., H. W., Mattoon, Ill.
Simplex Valve & Meter Co., Philadelphia, Pa.

GLASS, FIREPROOF. **(See Wire Glass.)**

GRADERS, ROAD
*Austin-Western Road Mchy. Co., Chicago, Ill.
*Baker Mfg. Co., Springfield, Ill.
*Good Roads Mchy. Co., Philadelphia, Pa.
*Holt Mfg. Co., Peoria, Ill.
*Koehring Machine Co., Milwaukee, Wis.
Adams & Co., J. D., Indianapolis, Ind.
Case Threshing Machine Co., J. I., Racine, Wis.
Kilbourne & Jacobs Mfg. Co., Columbus, O.
Lyle Culv. & Rd. Equip. Co., Minneapolis, Minn.
Russell Grader Mfg. Co., Minneapolis, Minn.

GRINDERS AND SAND RAMMERS
Chicago Pneumatic Tool Co., New York.
Cleveland Pneumatic Tool Co., Cleveland, Ohio.
Ingersoll-Rand Co., New York, N. Y.
Sullivan Machinery Co., Chicago, Ill.

GYPSUM PRODUCTS
U. S. Gypsum Co., Chicago, Ill.

HAMMERS, STEAM, PILE. **(See Pile Hammers, Steam.)**

HEAT INSULATING MATERIAL
*Carey Co., Philip, Cincinnati, Ohio.
John-Manville, Inc., New York.

HEATING KETTLES. **(See Kettles)**

HOISTS, BELT-DRIVEN
Dobbie Fdry. & Mach. Co., Niagara Falls, N. Y.
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Clyde Iron Works, Duluth, Minn.
Dobbie Fdry. & Mach. Co., Niagara Falls, N. Y.
Flory Mfg. Co., S., Bangor, Pa.
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Lidgerwood Mfg. Co., New York.
Mead-Morrison Mfg. Co., E. Boston, Mass.
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C. H. & E. Mfg. Co., Milwaukee, Wis.
Clyde Iron Works, Duluth, Minn.
Domestic Engine & Pump Co., Shippensburg, Pa.
Flory Mfg. Co., S., Bangor, Pa.
Lansing Co., Lansing, Mich.
Lidgerwood Mfg. Co., New York.
Monighan Machine Co., Chicago, Ill.
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Schramm & Son, Inc., Chris. D., Philadelphia, Pa.

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Insley Mfg. Co., Indianapolis, Ind.
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Hanna Eng. Works, Chicago, Ill.
Independent Pneumatic Tool Co., Chicago, Ill.
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Worthington Pump & Mchy. Corp., New York.

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Rensselaer Valve Co., Troy, N. Y.
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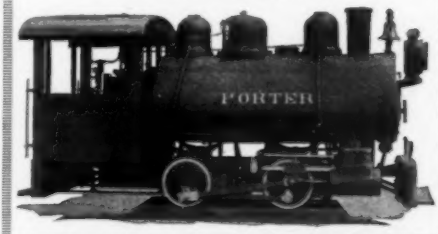

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METAL ROOFING (See "Roofing)

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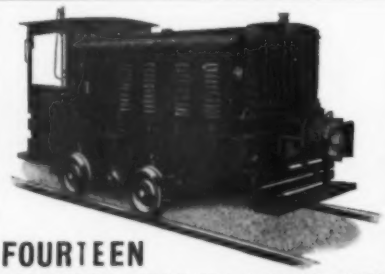

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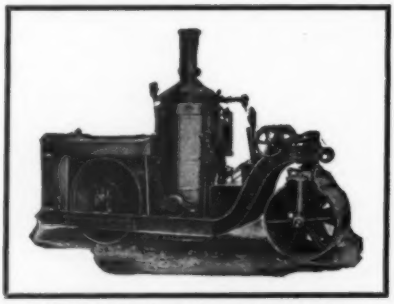

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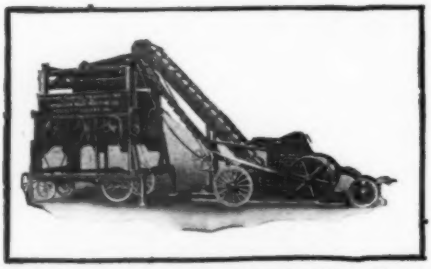

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Monarch Pressure Oil Distributor. Made in many sizes, horse drawn, or for mounting on auto trucks.

When it was so necessary as now for the Contractor, the City, State, County and Town Official to get the maximum production in road and street work at the smallest possible cost.

HOW CAN THIS BE DONE?

Very largely by the careful selection of high class machinery. The important part that is played by machinery in building and maintaining roads and streets is recognized by everyone. Reliable machinery—machinery that stands up and costs little for repairs, is the kind that keeps down production costs.

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Atlas Engineering Co., Milwaukee, Wis.
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Badger Concrete Mixer Co., Milwaukee, Wis.
Construction Machinery Co., Waterloo, Ia.
Cummer & Son Co., F. D., Cleveland, O.
East Iron & Machine Co., Lima, O.
Erie Machine Shops, Erie, Pa.
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National Cast Iron Pipe Co., Birmingham, Ala.
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*Honhorst Co., Jos., Cincinnati, Ohio.
*Littleford Bros. Cincinnati, Ohio.
*Pittsburgh Des Moines Steel Co., Pittsburgh, Pa.
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Blaw-Knox Co., Pittsburgh, Pa.
Canton Culvert & Silo Co., Canton, O.
Chatta. Boiler & Tank Co., Chattanooga, Tenn.
Chicago Bridge & Iron Works, Chicago, Ill.
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Hardesty Mfg. Co., R., Denver, Col.
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Tippet & Wood, Phillipsburg, N. J.

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Youngstown Sheet & Tube Co., Youngstown, O.

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*American Wood Pipe Co., Tacoma, Wash.
*Continental Pipe Mfg. Co., Seattle, Wash.
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*Redwood Mfrs. Co., San Francisco, Cal.
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*Central Foundry Co., New York.
*Crane Co., Chicago, Ill.
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Taylor Portable Steel Derrick Co., Chicago, Ill.

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*Pacific Plush Tank Co., Chicago, Ill.
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Leadite Company, Inc., Philadelphia, Pa.
Ruberoid Co., New York.

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*Holt Mfg. Co., Peoria, Ill.
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Case Threshing Machine Co., J. I., Racine Wis.
Deere & Co., Moline, Ill.
Dobbie Fdry. & Mach. Co., Niagara Falls, N. Y.
International Harvester Co., Chicago, Ill.
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Oliver Chilled Plow Works, South Bend, Ind.
Russell Grader Mfg. Co., Minneapolis, Minn.
Sidney Steel Scraper Co., Sidney, O.
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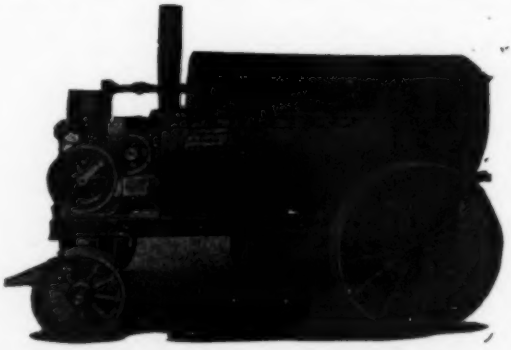

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PORTLAND CEMENT. **(See Cement.)**

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*Lea-Courtenay Co., Newark, N. J.
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Murray Iron Works Co., Burlington, Ia.
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Vogt Bros. Mfg. Co., Louisville, Ky.
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*Delaval Steam Turbine Co., Trenton, N. J.
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*Indiana Air Pump Co., Indianapolis, Ind.
*Lea-Courtenay Co., Newark, N. J.
Aurora Pump & Mfg. Co., Aurora, Ill.
Barnes Mfg. Co., Mansfield, O.
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Cameron Steam Pump Works, A. S., New York.
Clark Co., H. W., Mattoon, Ill.
Domestic Eng. & Pump Co., Shippensburg, Pa.
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Goulds Mfg. Co., Seneca Falls, N. Y.
Keystone Driller Co., Beaver Falls, Pa.
Manistee Iron Wks., Manistee, Mich.
Midwest Engine Co., Indianapolis, Ind.
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Schramm & Son, Inc., Chris. D., Philadelphia, Pa.
United Iron Works, Kansas City, Mo.
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Yeomans Bros. Co., Chicago, Ill.

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*Dayton-Dowd Co., Quincy, Ill.
*Fairbanks, Morse & Co., Chicago, Ill.
*Lea-Courtenay Co., Newark, N. J.
*Novo Engine Co., Lansing, Mich.
*Standard Scale & Supply Co., Pittsburgh, Pa.
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Deming Co., Salem, Ohio.
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Emerson Pump & Valve Co., Alexandria, Va.
Erie Pump & Engine Works, Medina, N. Y.
Goulds Mfg. Co., Seneca Falls, N. Y.
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Midwest Engine Co., Indianapolis, Ind.
Morris Machine Works, Baldwinsville, N. Y.
New York Eng. Co., New York.
Pulsometer Steam Pump Co., New York.
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Smith Co., T. L., Milwaukee, Wis.
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Van Nouhuys Machine Wks., Albany, N. Y.
Waldo Bros. & Bond Co., Boston, Mass.

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*Fairbanks, Morse & Co., Chicago, Ill.
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Aldrich Pump Co., Allentown, Pa.
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Clark Co., H. W., Mattoon, Ill.
Cook, A. D., Lawrenceburg, Ind.
Deming Co., Salem, O.
Goulds Mfg. Co., Seneca Falls, N. Y.
Keystone Driller Co., Beaver Falls, Pa.
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Weber Subterranean Pump Co., New York.

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Domestic Eng. & Pump Co., Shippensburg, Pa.
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*Kinney Mfg. Co., Boston, Mass.
*Koehring Machine Co., Milwaukee, Wis.
*Lea-Courtenay Co., Newark, N. J.
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*Northern Fire Apparatus Co., Minneapolis, Min.
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American Steam Pump Co., Battle Creek, Mich.
American Well Works, Aurora, Ill.
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Cameron Steam Pump Works, A. S., New York.
Deming Co., Salem, O.
Domestic Eng. & Pump Co., Shippensburg, Pa.
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Gilbert & Barker Mfg. Co., Springfield, Mass.
Goulds Mfg. Co., Seneca Falls, N. Y.
Ingersoll-Rand Co., New York.
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McGowan Co., J. H., Cincinnati, O.
Midwest Engine Co., Indianapolis, Ind.
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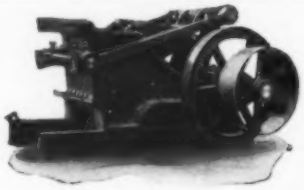
Lackawanna Steel Co., Buffalo, N. Y.
Sweet's Steel Co., Williamsport, Pa.
Zelnicker Supply Co., W., St. Louis, Mo.



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UNLESS it's a Western-Aurora,

the Jaw Crusher that is **DIFFERENT** because of its two-blow stroke which increases production, consumes less power and reduces vibration (wear and tear).

The Jaw Crusher with neither springs to break nor toggle to drop out.

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With or without Scarifier attachment.

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*Barber Asphalt Paving Co., Philadelphia, Pa.
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*Good Roads Machinery Co., Philadelphia, Pa.
*Holt Mfg. Co., Peoria, Ill.
*Kinney Mfg. Co., Boston, Mass.
*Koehring Machine Co., Milwaukee, Wis.
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Roebling's Sons Co., J. A., Trenton, N. J.
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Lufkin Rule Co., Saginaw, Mich.

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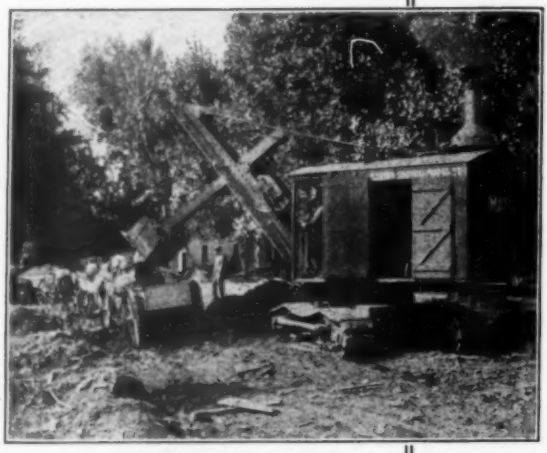
SAW RIGS, PORTABLE
*Knickerbocker Co., Jackson, Mich.
*Ransome Concrete Mach. Co., Dunnellen, N. J
*Standard Scale & Supply Co., Pittsburgh, Pa.
C. H. & E. Mfg. Co., Milwaukee Wis.
Oshkosh Mfg. Co., Oshkosh, Wis.

SCARIFIERS
*Acme Road Machy. Co., Frankfort, N. Y.
*Austin Western Road Mchy. Co., Chicago, Ill.
*Barber Asphalt Paving Co., Philadelphia, Pa.
*Buffalo Springfield Roller Co., Springfield, O.
*Good Roads Machinery Co., Philadelphia, Pa.
*Universal Road Mchy. Co., Kingston, N. Y.
Adams & Co., J. D., Indianapolis, Ind.
Galion Iron Works & Mfg. Co., Galion, O.
Huber Mfg. Co., Marion, O.
Lyle Cul. & Rd. Equip. Co., Minneapolis, Minn.
Russell Grader Co., Minneapolis, Minn.



Contractors want the shovel that will dig the most dirt in the least possible time. The Marion "21" with its inbuilt ruggedness and its ease of handling will keep the wagons or trucks loaded and on the move—demonstrating Marion *quality* and *dependability* through *service*.

The model 21 has a prominent place in our production schedule. It can be furnished with steam, gasoline or electric power.

We will take pleasure in serving you, if you'll give us your requirements.

The Marion Steam Shovel Co.
Marion, Ohio

NEW YORK CHICAGO ATLANTA SAN FRANCISCO

Results

THIS is the fifth member of a southern family of Thew Shovels. Its older brother was put on the job sixteen years ago and is still going strong.

You will note that this Thew is digging its way through a nasty little job in sticky Georgia mud and never noticing the tough roots or poor footing. Every dipper full goes up.

Your job may not be like this but you will want a shovel that can produce results.

THE THEW SHOVEL COMPANY
LORAIN, OHIO

Thew
Power Shovels

Bucyrus Revolving Shovels

ARE BUILT TO FINISH ANY JOB THEY START

The 30-B Universal Shovel shown above can be equipped as a Shovel, Dragline, Crane or Clamshell Excavator.

IT WILL PAY YOU TO INVESTIGATE

Send for Bulletin C-301-G

BUCYRUS COMPANY
South Milwaukee, Wisconsin.
351

SCRAPERS, ROAD
*Acme Road Machy. Co., Frankfort, N. Y.
*Austin-Western Road Mchy. Co., Chicago, Ill.
*Baker Mfg. Co., Springfield, O.
*Good Roads Machinery Co., Philadelphia, Pa.
Adams & Co., J. D., Indianapolis, Ind.
Case Threshing Machine Co., J. I., Racine, Wis.
East Iron & Machine Co., Lima, O.
Galion Iron Works & Mfg. Co., Galion, O.
Kilbourne & Jacobs Mfg. Co., Columbus, O
Lyle Culv. & Rd. Equip. Co., Minneapolis, Minn.
Root Spring Scraper Co., Kalamazoo, Mich.
Russell Grader Co., Minneapolis, Minn.
Sidney Steel Scraper Co., Sidney, O.
Western Wheeled Scraper Co., Aurora, Ill.

SCRAPERS, SELF-LOADING
*Baker Manufacturing Co., Springfield, Ill.
Smith & Sons Mfg. Co., Kansas City, Mo.

SCREENS, SAND, GRAVEL AND COAL
*Allis-Chalmers Mfg. Co., Milwaukee, Wis.
*Austin-Western Road Mchy. Co., Chicago, Ill.
*Good Roads Mach'y Co., Philadelphia, Pa.
*Littleford Bros., Cincinnati, O.
Atlas Eng. Co., Milwaukee, Wis.
Bartlett & Snow Co., Cleveland, O.
Chain Belt Co., Milwaukee, Wis.
Gifford-Wood Co., Hudson, N. Y.
Haiss Mfg. Co., Geo., New York.
Jeffrey Mfg. Co., Columbus, O.
Link-Belt Co., Philadelphia, Pa
Lyle Culv. & Rd. Equip. Co., Minneapolis, Minn.
New Jersey Wire Cloth Co., Trenton, N. J.
Robins Conv. Belt Co., N. Y. C.
Russell Grader Co., Minneapolis, Minn.
Sackett Screen & Chute Co., H. B., Chicago, Ill.
Webster Mfg. Co., Chicago, Ill.
Wickwire Spencer Steel Corp., Worcester, Mass.

SCREENS, SEWAGE
*Pacific Flush Tank Co., Chicago, Ill.
Chain Belt Co., Milwaukee, Wis.

SCREWS
American Screw Co., Providence, R. I.
Clark Bros. Bolt Co., Milldale, Conn.
St. Louis Screw Co., St. Louis, Mo.

SECOND-HAND EQUIPMENT
*Briggs, Inc., Marvin, Bkn., New York.
*Contractors Mach. & Supply Co., Pittsburgh, Pa.
*Craven Co., Frank T., New York.
*Curtiss-Willis Co., New York.
*Forsythe Bros., New York.
*Grey Steel Prod. Co., New York.
*King, Philip T., New York, N. Y.
*Weiss, B. M., Philadelphia, Pa.

SEWAGE DISPOSAL APPARATUS
*Dorr Co., The, New York City.
*Pacific Flush Tank Co., Chicago, Ill.

SEWAGE PUMPS AND EJECTORS
*Otterson Auto Eductor Co., Springfield, O.
Erie Pump & Eng. Works, Medina, N. Y.
Pacific Flush Tank Co., Chicago, Ill.
Walworth Mfg. Co., Boston, Mass.
Yeomans Bros. Co., Chicago, Ill.

SEWER BLOCKS, SEGMENT
American Vit. Products Co., Akron, O.
Denver Sewer Pipe & Clay Co., Denver, Col.
Dickey Clay Mfg. Co., W. S., Kansas City, Mo.
Macomb Sewer Pipe Wks., Macomb, Ill.
McNutt Meter Box Co., Brazil, Ind.
Red Wing Sewer Pipe Co., Red Wing, Minn.

SEWER CLEANING APPARATUS
*Turbine Sewer Machine Co., Milwaukee, Wis.
Champion Corporation, Hammond, Ind.
Healey, P. J., New York.
Thompson-Fleming Co., Inc., Buffalo, N. Y.

SEWER PIPE AND DRAIN TILE
*Delaware Clay Products Co., Pittsburgh, Pa.
American Vit. Products Co., Akron, O.
Blackmer & Post Pipe Co., St. Louis, Mo.
Dee Co., Wm. E., Chicago, Ill.
Denver Sewer Pipe & Clay Co., Denver, Col.
National Fireproofing Co., Pittsburgh, Pa.
Robinson Clay Product Co., Akron, O.

SEWER RODS
*Turbine Sewer Machine Co., Milwaukee, Wis.
Bissell Co., F., Toledo, O.
Champion Corporation, Hammond, Ind.

SHOVELS, ELECTRIC
*Bucyrus Co., South Milwaukee, Wis.
*Marion Steam Shovel Co., Marion, O.
*Thew Shovel Co., Lorain, O.

SHOVELS, GASOLINE
*Marion Steam Shovel Co., Marion, O.
*Pawling & Harnischfeger Co., Milwaukee, Wis.
*Thew Shovel Co., Lorain, O.
American Steel Dredge Co., Fort Wayne, Ind.
Austin Machinery Corp'n, Chicago, Ill.
Fairbanks Steam Shovel Co., Marion, O.

SHOVELS, HAND
American Shovel & Stamping Co., Lorain, O.
Ames Shovel & Tool Co., Boston, Mass.
Chisholm Shovel Co., Cleveland, O.
Conneaut Shovel Co., Conneaut, O.
Hubbard & Co., Pittsburgh, Pa.
Indiana Shovel Co., New Castle, Ind.
Pittsburgh Shovel Co., Pittsburgh, Pa.
Wood Shovel & Tool Co., Piqua, Ohio.
Wyoming Shovel Works, Wyoming, Pa.

SHOVELS, STEAM
*Bucyrus Co., South Milwaukee, Wis.
*Marion Steam Shovel Co., Marion, O.
*Thew Shovel Co., Lorain, O.
American Steel Dredge Co., Fort Wayne, Ind.
Austin Machinery Corp'n, Chicago, Ill.
Ball Engine Co., Erie, Pa.
Bellwood Steam Shovel Co., Bellwood, Pa.
Browning Co., Cleveland, O.
Byers Machine Co., J. P., Ravenna, O.
Fairbanks Steam Shovel Co., Marion, O.
Industrial Works, Bay City, Mich.
Keystone Driller Co., Beaver Falls, Pa.
Osgood Co., Marion, O.
Smith Co., T. L., Milwaukee, Wis.

SIGNS, STREET AND ROAD
Baltimore Enamel & Novelty Co., Baltimore, Md.
Ingram-Richardson Mfg. Co., Beaver Falls, Pa.
Lyle Culv. & Rd. Equip. Co., Minneapolis, Minn.
N. Y. Enameled Steel Sign Co., New York.
Thompson-Fleming Co., Inc., Buffalo, N. Y.
Union Iron Products Co., East Chicago, Ind.

SLEEVES, TAPPING AND VALVE
*Mueller Mfg. Co., Decatur, Ill.
*Rensselaer Valve Co., Troy, N. Y.
*Smith Mfg. Co., A. P., East Orange, N. J.

SLUICE GATES. **(See Gates, Sluice.)**

SNOW CLEANING MACHINERY
*Austin-Western Road Mchy. Co., Chicago, Ill.
*Baker Mfg. Co., Springfield, Ill.
*Cleveland Tractor Co., Cleveland, O.
*Good Roads Machinery Co., Philadelphia, Pa.
*Holt Mfg. Co., Peoria, Ill.
Barber-Greene Co., Aurora, Ill.
Toy Co., W. M., Sidney, Ohio.
J. T. Tractor Co., Cleveland, O.
Owensboro Ditcher & Grader Co., Owensboro, Ky.

SPREADERS, STONE
*Austin-Western Road Mchy. Co., Chicago, Ill.
*Burch Plow Works Co., Crestline, O.

STACKS, STEEL
*Heil Co., The, Milwaukee, Wis.
*Honhorst Co., Jos., Cincinnati, Ohio.
*Littleford Bros., Cincinnati, O.
Blaw-Knox Co., Pittsburgh, Pa.
Chatta. Boiler & Tank Co., Chattanooga, Tenn.
Chicago Bridge & Iron Works, Chicago, Ill.
Connery & Co., Inc., Philadelphia, Pa.
Honhorst Co., Jos., Cincinnati, O.
Petroleum Iron Works Co., Sharon, Pa.
Scaife & Sons Co., Wm. B., Pittsburgh, Pa.
Walsh & Weidner Boiler Co., Chattanooga, Tenn.

STEAM SHOVELS. **(See Shovels, Steam)**

STANDPIPES, TANKS AND TOWERS
*Fairbanks, Morse & Co., Chicago, Ill.
*Pacific Tank & Pipe Co., San Francisco, Cal.
*Pittsburgh-Des Moines Steel Co., Pittsburgh, Pa.
Blaw-Knox Co., Pittsburgh, Pa.
Caldwell Co., W. E., Louisville, Ky.
Chattanooga Blr. & Tank Co., Chattanooga, Tenn.
Chicago Bridge & Iron Works, Chicago, Ill.

Cletrac Takes Only Half the Space of a Team

and does the same work faster

HARD THIS WAY, BUT—

EASY ON A TRACK THE CLETRAC WAY

A Cletrac takes up about half the room required for one team and it does the work of 4 to 6 horses or mules on building construction jobs. It works faster, even in crowded places—it can turn around completely and quickly in a twelve foot circle.

There is plenty of power in Cletrac to pull full-loaded dump carts over soft ground. The broad tank-type tracks keep it from stalling in the mud or slipping if the ground is hard.

And best of all Cletrac sticks to the job in the hottest weather. Heat, dust or flies never bother it. You can see the Cletrac for yourself at the nearby dealer's. Or write direct to us for literature.

Cletrac
TANK-TYPE TRACTOR

THE CLEVELAND TRACTOR COMPANY
"Largest Producers of Tank-Type Tractors in the World"
19211 Euclid Avenue **Cleveland, Ohio**

Connery & Co., Inc., Philadelphia, Pa.
Eagle Tank Co., Chicago, Ill.
Lancaster Iron Wks., Lancaster, Pa.
Petroleum Iron Works Co., Sharon, Pa.
United Iron Works, Kansas City, Mo.
Walsh & Weidner Boiler Co., Chattanooga, Tenn.

STEAM TURBINES
***Allis-Chalmers Mfg. Co., Milwaukee, Wis.**
***DeLaval Steam Turbine Co., Trenton, N. J.**
***Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.**
Ingersoll-Rand Co., New York.

STEEL PLATE CONSTRUCTION
*Connery & Co., Philadelphia, Pa.
***Heil Co., The, Milwaukee, Wis.**
***Heltzel Steel Form & Iron Co., Warren, O.**
*Honhorst Co., Jos., Cincinnati, Ohio.
***Littleford Bros., Cincinnati, O.**
*Pittsburgh-Des Moines Steel Co., Pittsburgh, Pa.
Bethlehem Steel Bridge Co., Bethlehem, Pa.
Bigga Boiler Wks., Akron, O.
Birmingham Steel Corp., Birmingham, Ala.
Blaw-Knox Co., Pittsburgh, Pa.
Chatta. Boiler & Tank Co., Chattanooga, Tenn.
Chicago Bridge & Iron Works, Chicago, Ill.
McClintic-Marshall Co., Pittsburgh, Pa.
Pennsylvania Bridge Co., Beaver Falls, Pa.
Petroleum Iron Works Co., Sharon, Pa.
Riter-Conley Co., Pittsburgh, Pa.
Scaife & Sons, Wm. B., Pittsburgh, Pa.
Toledo Crane Co., Toledo, O.
Union Iron Works, Hoboken, N. J.
Vulcan Iron Works, Jersey City, N. J.
Walsh & Weidner Boiler Co., Chattanooga, Tenn.

STOKERS, MECHANICAL
***Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.**
Babcock & Wilcox Co., N. Y. C.

STREET LAMP POSTS
***Electric Railway Equipment Co., Cincinnati, O.**
***General Elec. Co., Schenectady, N. Y.**
***King Mfg. Co., Chicago, Ill.**
***Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.**
*Union Metal Mfg. Co., Canton, O.

STREET AND ROAD SIGNS. (See Signs, Street and Road.)

STREET CLEANERS AND FLUSHERS
***Austin-Western Road Mchy. Co., Chicago, Ill.**
***Elgin Sales Corp'n., New York.**
***Federal Motor Truck Co., Detroit, Mich.**
***Good Roads Machinery Co., Philadelphia, Pa.**
***Municipal Supply Co., South Bend, Ind.**
***Rochester Can Co., Rochester, N. Y.**
***Tiffin Wagon Co., Tiffin, O.**
***Universal Road Mchy. Co., Kingston, N. Y.**
***White Company, Cleveland, O.**
Autocar Co., Ardmore, Pa.
Etnyre & Co., E. D., Oregon, Ill.
Four Wheel Drive Auto Co., Clintonville, Wis.
Service Motor Truck Co., Wabash, Ind.
Thompson-Fleming Co., Inc., Buffalo, N. Y.

STREET CLEANERS' CARTS
*Rochester Can Co., Rochester, N. Y.
*Tarrant Mfg. Co., Saratoga Springs, N. Y.
Durlach Can & Iron Works, Brooklyn, N. Y.

STRUCTURAL STEEL AND IRON. (See Bridges and Buildings)

STUMP PULLERS
Bennett & Co., H. L., Westerville, O.
Carpenter & Co., Geo. B., Chicago, Ill.
Clyde Iron Works, Duluth, Minn.
Lewis & Valentine, Roslyn, L. I.
Thomas Elevator Co., Chicago, Ill.

SURVEYORS' INSTRUMENTS. (See Instruments.)

TABLES AND BOARDS, DRAWING. (See Drawing Materials.)

TAMPING MACHINES
***Pawling & Harnishfeger Co., Milwaukee, Wis.**
Construction Mach'y Co., Waterloo, Ia.

TANKS, AIR COMPRESSOR
***Heil Co., Milwaukee, Wis.**
***Indiana Air Pump Co., Indianapolis, Ind.**
***Littleford Bros., Cincinnati, O.**
***Pittsburgh-Des Moines Steel Co., Pittsburgh, Pa.**
Abendroth & Root Mfg. Co., New York.
Bigga Boiler Wks., Akron, O.
Chicago Bridge & Iron Works, Chicago, Ill.
Connery & Co., Inc., Philadelphia, Pa.
Ingersoll-Rand Co., New York.
Lancaster Iron Wks., Lancaster, Pa.
National Tube Co., Pittsburgh, Pa.
Petroleum Iron Works Co., Sharon, Pa.
Scaife & Sons Co., W. B., Pittsburgh, Pa.
Westinghouse Tract. Brake Co., Wilmerding, Pa.
Worthington Pump & Machy. Corp., New York.

TANKS FOR OIL
***Heil Co., Milwaukee, Wis.**
***Honhorst Co., Jos., Cincinnati, Ohio.**
***Littleford Bros., Cincinnati, O.**
***Pacific Tank & Pipe Co., San Francisco, Cal.**
***Pittsburgh-Des Moines Steel Co., Pittsburgh, Pa.**
Bigga Boiler Works Co., Akron, O.
Bowser & Co., S. F., Fort Wayne, Ind.
Chatta. Boiler & Tank Co., Chattanooga, Tenn.
Chicago Bridge & Iron Works, Chicago, Ill.
Connery & Co., Philadelphia, Pa.
Dover Boiler Works, New York.
Fouts Co., C. C., Middletown, O.
Petroleum Iron Works Co., Sharon, Pa.
Riter-Conley Co., Pittsburgh, Pa.
Scaife & Sons Co., Wm. B., Pittsburgh, Pa.
United Iron Works, Kansas City, Mo.
Walsh & Weidner Boiler Co., Chattanooga, Tenn.
Wayne Oil Tank & Pump Co., Ft. Wayne, Ind.

TANKS, STEEL
***Heil Co., Milwaukee, Wis.**
***Honhorst Co., Jos., Cincinnati, Ohio.**
***Littleford Bros., Cincinnati, O.**
***Pittsburgh-Des Moines Steel Co., Pittsburgh, Pa.**
Bigga Boiler Wks., Akron, O.
Caldwell Co., W. E., Louisville, Ky.
Chatta. Boiler & Tank Co., Chattanooga, Tenn.
Chicago Bridge & Iron Works, Chicago, Ill.
Columbian Steel Tank Co., Kansas City, Mo.
Connery & Co., Inc., Philadelphia, Pa.
Hardesty Mfg. Co., R., Denver, Col.
Lancaster Iron Works, Lancaster, Pa.
Petroleum Iron Works Co., Sharon, Pa.
Scaife & Sons, Wm. B., Oakmont, Pa.

TANKS, WOOD
***Pacific Tank & Pipe Co., San Francisco, Cal.**
Caldwell Co., W. E., Louisville, Ky.
Davis & Son, G. M., Palatka, Fla.
Eagle Tank Co., Chicago, Ill.
Hauser-Stander Tank Co., Cincinnati, O.
Kalamazoo Tank & Silo Co., Kalamazoo, Mich.
National Tank & Pipe Co., Portland, Ore.
Redwood Manufacturers Co., San Francisco, Calif.
Scaife & Sons, Wm. B., Oakmont, Pa.
Stearns Lumber Co., A. T., Boston, Mass.
U. S. Wind Engine & Pump Co., Batavia, Ill.
Wendnagel & Co., Chicago, Ill.

TANK WAGONS
***Acme Road Mach. Co., Frankfort, N. Y.**

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Dietzgen Co., Eugene, New York.
Keuffel & Esser Co., Hoboken, N. J.
Kolesch & Co., New York.
Lufkin Rule Co., Saginaw, Mich.
Starrett, L. S., Athol, Mass.

TAR
***Barrett Co., New York.**

TAR KETTLES. (See Kettles)

TIES, STEEL
***Koppel Industrial Car & Equip. Co., Koppel, Pa.**
Carnegie Steel Co., Pittsburgh, Pa.
Sweet's Steel Co., Williamsport, Pa.

TIRES, RUBBER. (For Motor Trucks.)
***Kelly Springfield Tire Co., New York.**
Firestone Tire & Rubber Co., Akron, O.
Goodrich Rubber Co., B. F., Akron, O.
Goodyear Tire & Rubber Co., Akron, O.
Republic Rubber Co., Youngstown, O.
U. S. Tire Co., New York.

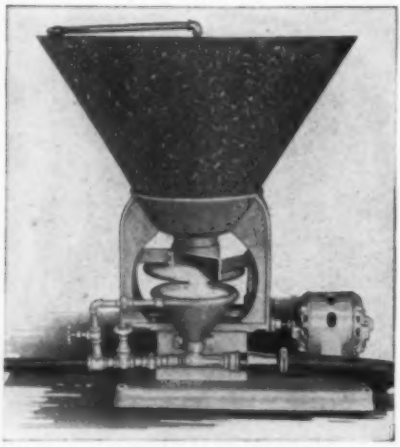
TOOL HOUSES, PORTABLE STEEL
***Littleford Bros., Cincinnati, O.**

TOWERS (See Standpipe Tanks and Towers)

TRACKS, INDUSTRIAL AND PORTABLE
*Easton Car & Constn. Co., New York.
***Koppel Ind. Car & Equipment Co., Koppel, Pa.**
Chase Fdry. & Mfg. Co., Columbus, O.
Hunt Co., Inc., C. W., West New Brighton, N. Y.
Lakewood Engineering Co., Cleveland, O.
Light Railway Equipment Co., Philadelphia, Pa.

TRACTORS
***Allis-Chalmers Mfg. Co., Milwaukee, Wis.**
***Cleveland Tractor Co., Cleveland, O.**
***Dayton-Dowd Co., Quincy, Ill.**
***Fairbanks, Morse & Co., Chicago, Ill.**
***Holt Mfg. Co., Peoria, Ill.**
***White Company, The, Cleveland, O.**

* *Indicates that the manufacturer carries an advertisement.* *See index facing inside back cover.*



The Booth Dry Feeder, manufactured and marketed by the W & T Organization.

The Dry Feed of Chemicals

in Water Purification has many advantages over the application and control of chemical solutions, such as alum, soda-ash, sulphate of iron, and lime.

Dry Feed application brings an end to difficulties from leaking tanks, broken valves, clogged orifices, and the multitudinous troubles of solution feed systems.

Wallace & Tiernan Company have recognized the need for a Dry Feed system of high merit, and unquestioned reliability, and after considerable research, the Booth Dry Feeder was adopted. Now it is manufactured and marketed by the same organization that is responsible for the place which 'W & T' holds in the water purification field.

The Booth Dry Feeder is ruggedly built. It gives positive accurate control of dry chemicals. The rate of flow can be changed by a simple adjustment of the collar at the base of the hopper. All working parts are in plain view at all times.

We are prepared to quote this equipment if you will send us information about your requirements.

A folder showing a diagrammatic sketch of the Booth Dry Feed and discussing its mechanical features has been prepared. Will you write us for a copy of it?

WALLACE & TIERNAN CO., Inc.

Manufacturers of Chlorine Control Apparatus for Water Purification and Industrial Purposes.

NEWARK, NEW JERSEY

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Best Tractor Co., C. L., San Leandro, Cal.
Case Threshing Machine Co., J. I., Racine, Wis.
Clark Tructractor Co., Chicago, Ill.
Dart Truck & Tractor Corp., Waterloo, Ia.
Four Wheel Drive Auto Co., Clintonville, Wis.
Hart-Parr Co., Charles City, Iowa.
Huber Mfg. Co., Marion, O.
J. T. Tractor Co., Cleveland, O.
Oliver Tractor Co., Knoxville, Tenn.
Selden Truck Corp'n., Co., Wabash, Ind.
Service Motor Truck Co., Wabash, Ind.
Watson Products Corp., Canastota, N. Y.

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Eagle Wagon Works, Auburn, N. Y.
Highway Trailer Co., Edgerton, Wis.
Lee Trailer & Body Co., Chicago, Ill.
Troy Wagon Works, Troy, O.
Warner Mfg. Co., Beloit, Wis.
Watson Products Corp'n., Canastota, N. Y.

TRAILERS, INDUSTRIAL
Chase Fdry. & Supply Co., Columbus, O.
Electric Wheel Co., Quincy, Ill.
Lakewood Engineering Co., Cleveland, O.
Lee Trailer & Body Co., Chicago, Ill.

TRAMWAYS, AERIAL WIRE ROPE
Broderick & Bascom Rope Co., St. Louis, Mo.
Leschen & Sons Rope Co., A., St. Louis, Mo.

TRANSFORMERS
*Allis-Chalmers Mfg. Co., Milwaukee, Wis.
*General Electric Co., Schenectady, N. Y.
*Westinghouse Elec. & Mfg. Co., E. Pittsb'gh, Pa.
Kuhlman Electric Co., Bay City, Mich.

TRANSITS AND LEVELS. (See Instruments.)

TRANSMISSION MACHINERY, POWER
*Allis-Chalmers Mfg. Co., Milwaukee, Wis.
*General Electric Co., Schenectady, N. Y.
*Weller Mfg. Co., Chicago, Ill.
Dodge Mfg. Co., Mishawaka, Ind.
Link Belt Co., Chicago, Ill.
Webster Mfg. Co., Chicago, Ill.

TREADS, SAFETY
American Abrasive Metals Co., New York.
American Mason Safety Tread Co., Lowell, Mass.
Concrete Steel Co., New York.
Irving Iron Works, Long Island City.

TRENCH EXCAVATORS, (see Excavators, Ditch & Trench)

TURBINES
*Allis-Chalmers Mfg. Co., Milwaukee, Wis.
*De Laval Steam Turbine Co., Trenton, N. J.
*General Electric Co., Schenectady, N. Y.
*Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.
Ingersoll-Rand Co., New York.
Midwest Engine Co., Indianapolis, Ind.

USED MACHINERY
*Briggs, Inc., Marvin, Bkn., New York.
*Craven Co., Frank T., New York.
*Curtiss-Willis Co., New York.
*Forsythe Bros., New York.
*Grey Steel Prod. Co., New York.
*King, Philip T., New York, N. Y.
*Weiss, B. M., Philadelphia, Pa.

VALVE CONTROL APPARATUS, ELECTRIC
*Payne Dean Ltd., New York.

VALVES, GATE AND INDICATOR POSTS
*Crane Company, Chicago, Ill.
*Norwood Engineering Co., Florence, Mass.
*Smith Mfg. Co., A. P., East Orange, N. J.
Chapman Valve Mfg. Co., Indian Orchard, Mass.
Darling Valve Mfg. Co., Williamsport, Pa.
Eddy Valve Co., Waterford, N. Y.
Fairbanks Co., The, New York.
Iowa Valve Co., Oskaloosa, Ia.
Kennedy Valve Mfg. Co., Elmira, N. Y.
Ludlow Valve Co., Troy, N. Y.
Lunkenheimer Co., Cincinnati, O.
Pratt & Cady Co., Inc., Hartford, Conn.
Rensselaer Valve Co., Troy, N. Y.
Wood & Co., R. D., Philadelphia, Pa.

VALVE BOXES AND HOUSINGS
*Central Foundry Co., New York.
*Mueller Mfg. Co., H., Decatur, Ill.
*Smith Mfg. Co., A. P., East Orange, N. J.
*U. S. C. Ir. Pipe & Fdry. Co., Burlington, N. J.
Chapman Valve Mfg. Co., Indian Orchard, Mass.
Clark Co., H. W., Mattoon, Ill.
Clow & Sons, J. B., Chicago, Ill.
Columbian Iron Works, Chattanooga, Tenn.
Darling Valve Mfg. Co., Williamsport, Pa.
Eddy Valve Co., Waterford, N. Y.
Fairbanks Co., The, New York.
Iowa Valve Co., Oskaloosa, Ia.
Kennedy Valve Mfg. Co., Elmira, N. Y.
Ludlow Valve Co., Troy, N. Y.
Pratt & Cady Co., Inc., Hartford, Conn.
Rensselaer Valve Co., Troy, N. Y.
S. E. T. Valve & Hydrant Co., New York.
Wood & Co., R. D., Philadelphia, Pa.

VENTILATORS
American Blower Co., Detroit, Mich.
Edwards Mfg. Co., Cincinnati, O.
Milwaukee Corrugating Co., Milwaukee, Wis.

WAGONS AND TRUCKS
*Tiffin Wagon Co., Tiffin, O.
*White Company, The, Cleveland, O.
Acme Wagon Co., Emigsville, Pa.
Eagle Wagon Works, Auburn, N. Y.
Lyle Culv. & Rd. Equip. Co., Minneapolis, Minn.
Russell Grader Mfg. Co., Minneapolis, Minn.
Troy Wagon Works, Troy, O.
Watson Products Corp'n., Canastota, N. Y.
Western Wheeled Scraper Co., Aurora, Ill.

WAGON BODIES. (See Dump Bodies)

WAGON LOADERS. (See Loaders, Gravel and Wagon)

WALLBOARD
*Carey Co., Philip, Cincinnati, Ohio.
Beaver Board Companies, Buffalo, N. Y.
Bird & Son E. Walpole, Mass.
Cornell Wood Products Co., Chicago, Ill.
Haverhill Box Board Co., Haverhill, Mass.
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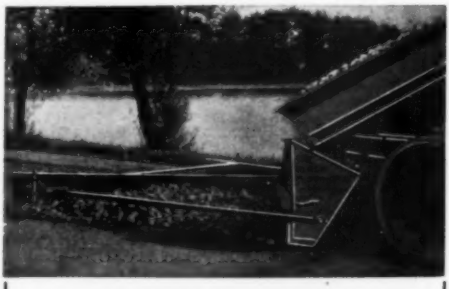

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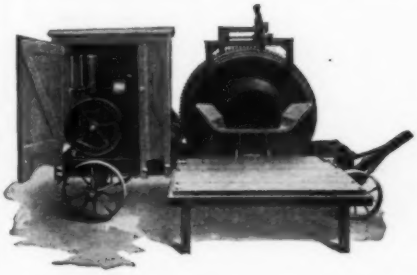

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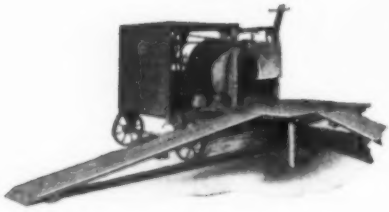
Write for facts and figures on the operating costs, thorough mixing, quick discharge, simplicity of operation and freedom from maintenance troubles, of Ransome Bantam Mixers.



Ransome Bantam Mixer working on International Banking Corporation Bldg., Tiensin, China. Fu Hsing Engineering Corporation, Contractor. Murphy & Dana, Architects. Photographs By Roy H. Skelton.

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CONTRACTORS' & ENGINEERS' MONTHLY

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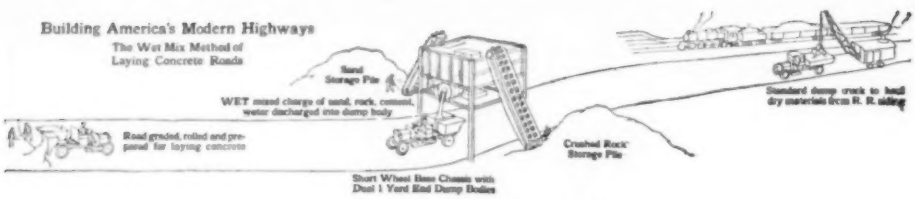
Vol. 3 — CONTENTS FOR JULY, 1921 — No. 1

EDITORIAL

Combining a State Highway and a Dike for Flood Protection 41
War vs. Carelessness 43
Why Is a Specification? 44
Portable Electric Drills 45
Efficient Methods Applied to Concrete Road Construction 47
Dumping Equipment for Road Contractors 50
No Cut—No Building 51
The Value of Calculating Machines for Contractors and Engineers 52
Stone-Spreading Attachments for Motor Trucks 54
The Value of Small Tractors in Road Work 55
The Origin and Use of the Steam Pile Hammer 56
Why Contractors Lose Money 57
A Valuable New Method for Ditching 58
Kerosene Heater for Road Departments and Water-Works 59
Triplex Pumps in Road Construction 60
Sand and Gravel Rates 60
Get These Good Catalogs 61
Contractors', Engineers' and Manufacturers' Notes 63
Small and Large Machinery at Work 64
Survey Plans and Specifications in Road Building 66
Portable Rock Breakers 67
Fifteen Big Trucks Build Better Roads 68
The Construction of the Jersey City Prize-Fight Arena 69
The General Contractor 71
Heavy Hauling Over Mountain Ranges 71
Labor-Saving Equipment Reduced Cost on Cleveland Building Job 73
The Proposed Crude Oil Tariff 73
A Road-Building Tractor 74
Power-Loading and Low-Charging Concrete Mixers 74
A New Type of Electrically Welded Chain 76
A Road Plow with Steel Beams 76
A New Side-Dump Body for Contractors' Trucks 78


Building America's Modern Highways
The Wet Mix Method of
Laying Concrete Roads
Sand
Storage Pile
WET mixed charge of sand, rock, cement, water discharged into dump body
Road graded, rolled and prepared for laying concrete
Crushed Rock
Storage Pile
Standard dump truck to haul dry materials from R. R. siding
Short Wheel Base Chassis with
Dual 1 Yard End Dump Bodies

It takes more than mere mechanical ability to make a truck so pre-eminently successful as Federal

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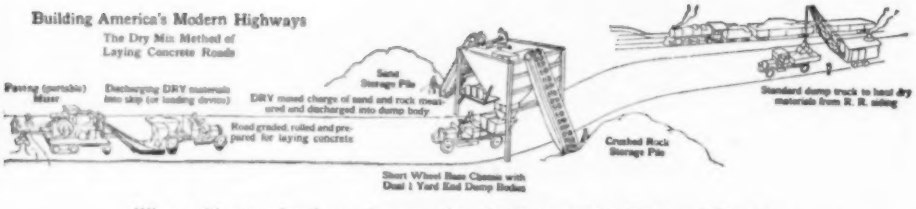
One to Seven Ton Capacities


Building America's Modern Highways
The Dry Mix Method of
Laying Concrete Roads
Paving (portable) Mixer
Discharging DRY materials into skip (or loading device)
Sand
Storage Pile
DRY mixed charge of sand and rock measured and discharged into dump body
Road graded, rolled and prepared for laying concrete
Crushed Rock
Storage Pile
Standard dump truck to haul dry materials from R. R. siding
Short Wheel Base Chassis with
Dual 1 Yard End Dump Bodies

Contractors' & Engineers' Monthly

New York July, 1921

Combining a State Highway with a Dike for Flood Protection

Detailed Description of Dragline Operation in the Construction of the North and South Highway at St. Maries, Idaho

THE North and South Highway of Idaho, now under construction, coming from the south strikes the valley of the St. Joe River at the thriving little town of St. Maries. This river rises in the Bitter Root Mountains and empties in Coeur d'Alene Lake, draining an area of approximately 1,375,000 acres. It is navigable for about 35 miles for large-size boats and has been used as a means of transportation for 40 years. It is said to be the highest navigable stream in the world.

From the head of navigation to the lake, the river winds through a wide and very fertile valley, which is flooded annually, when the river rises. The extreme rise and fall of the river is about 16 feet.

For years many attempts were made by ranchers occupying lands in the valley to protect their lands from the annual overflow by building dikes. But, owing to the fact that these dikes were never properly constructed in regard to width, side slopes and heights, failures were common and frequent. Later, under the provisions of the drainage laws of Idaho, drainage districts were formed and funds raised to be applied to the construction of dikes protecting larger areas. The same errors regarding design of dike sections were continued, and failures often resulted during unusual high-water stages.

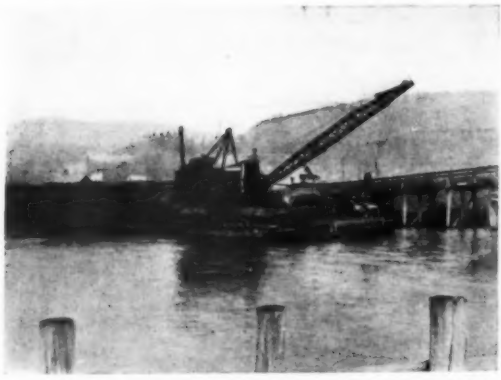
A New Idea in State Highway Construction

When construction of the North and South Highway reached the St. Joe Valley, engineers in charge of the work decided on a very unusual method of construction. They proposed to combine the state highway with a dike to prevent flooding of the lands near the river, by running the highway along the top of the dike.

From a highway engineering standpoint the proposition of building a combined state highway and dike is unique. Objection was taken on the ground that the state was not in the business of building dikes or reclaiming lands. However, W. I. Bassett, State District Engineer, and J. B. Sargent, Resident Engineer, who were in charge of

FINISHING THE DIKE SECTION NEAREST ST. MARIES

After finishing this section the dragline was moved, as shown on page 42



THE DRAGLINE MOUNTED ON A BARGE
After completing one section of the dike, the dragline was mounted as shown and floated 6 miles downstream to the next section of the dike

the work, took the position that governments as well as individuals should be in the business of doing all they can to improve conditions so that more homes may be created, more agricultural products raised, and the amount of taxable property increased. Mr. Bassett was strongly in favor of the idea from the outset, and to him is due most of the credit for putting it over. Authorities in charge of highway work in the state finally agreed to the building of the combined highway and dike, and work was started. The project was known as Federal Aid Project No. 31 and was financed jointly by the Federal Government, the state of Idaho and the local highway district.

Description of the Work

The amount of the contract, which was awarded to the General Construction Company of Spokane, Wash., was $211,293.23. The contract calls for the construction of 8 miles of the North and South Highway surfaced with 6 inches of crushed rock macadam, with grading, clearing culverts, etc.

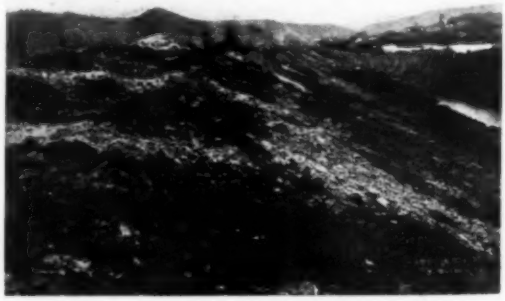
Two sections of the highway will serve the double purpose of dike and highway. The highway crosses the St. Joe River at St. Maries over a drawbridge, and it is here that the first dike section begins. The highway follows the river here for about two miles, and this dike reclaims about 500 acres of land. The highway then follows the foothills for about two and three-quarter miles before it strikes the river again. The second dike section then begins, and continues along the river for about three miles, reclaiming about 900 acres of land. The project ends with the end of this section.

The maximum fill necessary on the dike sections is 16½ feet; the minimum fill is about 7 feet. The cross-section consists of the 20-foot roadbed, with a 2½ to 1 slope toward the river and 1 to 1½ slope on the other side. Between the dike sections the excavation is sidehill work. The sidehill excavation was done with wheelers, fresnos and trucks.

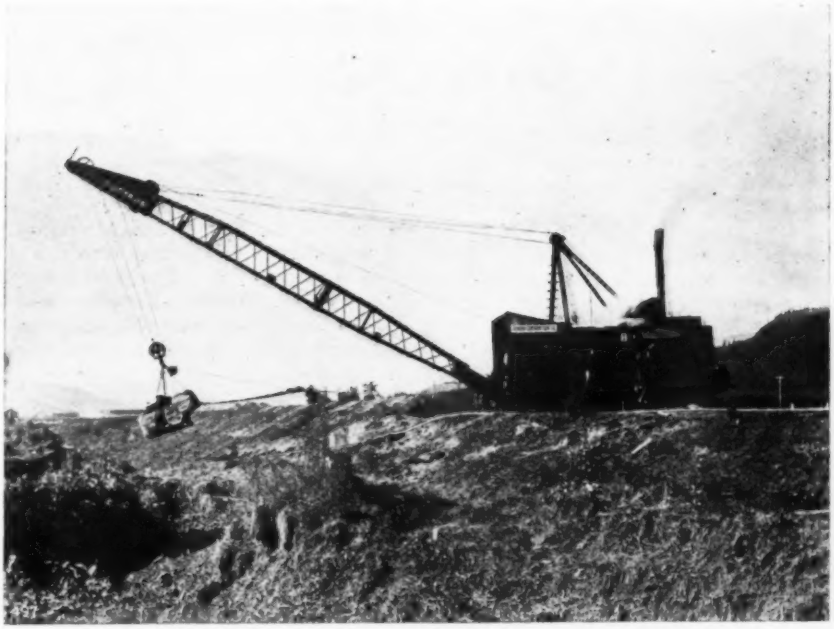
Dragline Operation

Excavation for the dike was done with a Class 14 Bucyrus dragline, equipped with a 60-foot boom and a 2-yard bucket. The centerline of the dike was run on an average of 120 feet back from the river, just far enough back to grab a portion of an old dike which ran along the shore of the river.

The contractors were able to get enough dry dirt out of this old dike to make the new fill stand in good shape. Long poles were set ahead of the fill with cross-bars at grade. The top of the fill was carried to a shrinkage grade, about 15 per cent, and was leveled off roughly by hand labor. The



THE ST. MARIES DIKE
Showing narrow section of bank left between the borrow-pit and river to avoid wet digging. In some places the pit was carried 10 feet below river level



A CLASS 14 BUCYRUS DRAGLINE WORKING ON THE COMBINED STATE HIGHWAY AND DIKE NEAR ST. MARIES, IDAHO

final finishing was done later by teams and scrapers.

As our photographs show, most of the dirt for the fill was taken from the area between the dike and the river. The slope of the borrow-pit was 2½ to 1. A rim of bank was left between the pit and the river to prevent wet digging. In some places the bottom of the borrow-pit was carried 10 feet below the level of the river without serious trouble from water. The dragline worked along ahead of the fill at about the toe of the slope.

The dragline crew consisted of six men per shift, and two shifts per day were worked. The average yardage made per day was 2,310 cubic yards. The record yardage was about 2,700 cubic yards.

After the dragline work on the section of dike nearest St. Maries had been completed, the dragline was loaded on a barge and floated down the river to the last section of dike.

The engineers in charge of the work deserve a great deal of credit for their foresight in this plan of combining a state highway with a dike. This not only makes a very good foundation for a highway, but reclaims over 1,400 acres of fertile farm land.

War vs. Carelessness

In 18 months of the bloodiest and most terrible war the world has ever known, 48,000 Americans lost their lives amid the hail of billions of scraps of steel and leaden balls. In one year—every year—20,000 Americans are killed by fire. There was a reason for the loss in battle. There is no excuse for the loss at home. The loss of 48,000 was to make the world safe for posterity; the loss of 20,000 is due to carelessness; it is the suicide of ignorance.

Why Is a Specification?*

By LAURANCE H. HART

THE purchasing agent who sets about buying a material must make plain to the manufacturer just what his requirements are. This he may do in two ways: (1) by indicating the purpose for which the material is to be used; or (2) by stating definitely the characteristics desired in the material to be furnished.

If the first method is followed, as many different materials might be furnished as there are bidders on the item, for each manufacturer would have his own idea as to what would best meet the requirements. When all these bids are received by the purchasing agent, each having its different prices attached, how shall he choose among them? The cheapest material may not be satisfactory in many respects, but the difference in price may be considerable. How shall he evaluate or compare the prices with the merits of the materials. It is purely guesswork, for a purchasing agent has not the training, experience or judgment to guide him in matters of so technical a nature.

The second method of purchasing is preferable in that it is in accordance with a standard agreed on by engineers, chemists, practical men and executives representing both the buyer and the seller, who have discussed the merits of the case in conference and decided just how far to go in insisting on certain qualifications in the desired material. The presence of practical men in such a conference insures the specification against requirements that are excessively refined or over-technical. This is, of course, an advantage not only to the manufacturer, but also to the purchaser of materials, since all costs are naturally added to the price of the material.

One distinct advantage of employing this method is that when the specification has once been adopted there is a clear understanding for guidance until revision is agreed upon.

Disadvantage of No Specification

Many industries are at present laboring under the handicaps resulting from unsatisfactory specifications, as in any business transaction the absence of a clear understanding always leads to difficulties. The buyer who does not understand the properties of various materials may inadvertently misuse or abuse them. If a good material is spoiled in this manner, it will in all probability never be purchased again. Moreover, there is a tendency not to purchase materials that are not well understood.

A case in point is the situation in Richmond, Va., where the workmen were accustomed to quick-slaking limes, having no specifications to refer to, but just buying "lime." A certain manufacturer shipped in many car-loads of a cool lime. The workmen, not knowing how to handle it, pronounced it of poor quality. It was improperly slaked, causing unsatisfactory walls. Quite without any basis, the lime itself was blamed for the situation. The consequence is that the proposed Richmond building code, as written in January, 1921, contained a clause forbidding the use of lime for any interior plaster. This was corrected after protest by the National Lime Association, but might have been prevented entirely had proper specifications for the materials and directions for their manipulation been available.

Another example may be cited: The specification of the supervising architect to the United States Government entirely forbids the use of lump lime for plaster. This is because the architect feels that he cannot be sure of what he is getting when the job is at a distance from his office, and that he is compelled to use hydrated lime which is ready for use. Here again the situation can be corrected by a specification.

American Demand for Standards and Grades

The average American demands modern conveniences not only in his living conditions, but in his business relations as well. He demands classification in the products that he buys so that he may save time and mental effort in his decisions and yet know what he is getting. He buys not "soap" in general, but toilet, bath, shaving, or sham-

* Copyright, 1921.

poo soap in particular. He buys not simply "paper," but wrapping, letter, news, tissue, crepe, or blotting paper—whatever he knows fits his purpose. The product that is graded, that is easily identified, that is used according to familiar formula, is the one that is going to make a permanent place for itself in modern business competition.

Specifications for quicklime and hydrated lime were drawn up by the American Society of Testing Materials several years ago and have just been revised in the light of recent developments, so that one may now buy these materials with reasonable confidence that they will be suitable and satisfactory.

Advantages Secured by Specifications

A definite understanding will benefit the manufacturers in many ways. Here are a few advantages, briefly stated:

1. A uniform specification enables buyer and seller to speak the same language.
2. It compels competitors to speak in one's language also, thus leading to fairness in competition.
3. It lowers costs by reducing the number of different specifications.
4. It simplifies the carrying of stock, and makes deliveries quicker.
5. It decreases litigation and argument over whether the material is satisfactory or not.
6. It stabilizes production by broadening the market and making it safe to accumulate large stocks.
7. It decreases selling expenses.
8. It acts as a stimulus to research, for it brings out the need of new information as to what is best.
9. It eliminates practises based on tradition or "happenstance."
10. It gives proper recognition to the manufacturer who spends large amounts of time and money in perfecting his product.

Portable Electric Drills

THE pistol grip and trigger switch of the portable electric drills made by the Black & Decker Manufacturing Company, Towson, Baltimore, Md., enable the operator to control the tool like an automatic pistol. This increases his efficiency and at the same time makes his work easier, as he can forget the control, which is practically automatic, and devote his entire attention to guiding the tool. It also reduces drill-bit breakages, as the operator naturally tightens his grip and instinctively pulls the trigger, stopping the drill, if the drill-bit catches on a burr, or when it breaks through the work. There is no danger of the drill's sagging onto the bit and breaking it when the mechanic operates the switch, as he does not have to change the position of his hands in the slightest degree. This also lessens the risk of inaccurate centering in starting the hole.

A PORTABLE ELECTRIC DRILL IN USE

The switch itself has many mechanical advantages. There are only three moving parts: the trigger; the pawl which engages the ratchet; and the contact block. The spring contact blades themselves snap the circuit open with a minimum amount of arcing. There is practically nothing to get out of order.

The drill-spindle is offset for close corner drilling. It runs in a long bronze bushing and against a ball-thrust bearing. Gears are cut from special steel heat-treated and mounted on shafts ground to size, which run in generous bronze bearings. No gears run on studs. The gear train is packed in grease in a separate grease-tight compartment like an automobile transmission; consequently the gears give maximum service with minimum attention.

The motor is designed and built especially for these drills and will operate on direct current or alternating current of 25, 40 or 60 cycles, or on any two wires of a three-phase circuit up to 60 cycles. The drills are made for 110, 220 or 332 volts. They will operate satisfactorily on voltages 10 per cent above or below these.

The motor is air-cooled by means of a fan on the armature shaft which sucks air in over the commutator, draws it all through the housing and expels it at the opposite end. These drills will not overheat under the most severe conditions of operation. In testing, they have actually been run wild for fourteen weeks,

SECTIONAL VIEW OF A BLACK & DECKER PORTABLE ELECTRIC DRILL

night and day, including Sundays and holidays, stopping only to renew brushes.

The commutator end cover is entirely separate from the armature-shaft-bearing support, and can be easily removed for inspection and adjustment of brushes without interfering with the operation of the motor. This also prevents binding of the armature shaft in the bearing should the end cover be distorted by dropping the drill or by applying excessive pressure with a feed screw.

These drills can be equipped with stands to convert them into bench drills or post drills for precision drilling.

GRADING BOTH SIDES OF A ROAD AT ONCE BY USING A HOLT TRACTOR AND TWO GRADERS. The cable in the foreground limits the distance the two machines can work apart, namely, the outside width of road and shoulders

Efficient Methods Applied to Concrete Road Construction

By J. M. HICKS

Superintendent of Paving, Clifton, Appelgate & Toole, Contractors, Anaconda, Mont.

CONSTRUCTION of the Anaconda end of the Butte-Anaconda Highway progressed steadily with a minimum of labor and at a maximum rate of speed largely because the work was planned to eliminate as much lost motion as possible. The entire job was so organized that each operation followed in proper sequence without delay. Workers were paid on a bonus system based on the current rate of pay for a fair day's work.

This contract is known as Federal Aid Project No. 68, and required 9.375 miles of concrete road between Butte and Anaconda. The work was done under the supervision of the Montana Highway Commission. Pavement was 18 feet wide, 6 inches thick at the edge, and 8 at the center. Concrete was proportioned 1:2:3, the Montana state standard mixture.

Aggregates were delivered so as to eliminate handling as much as possible. They were shipped in steel bottom-dump ore cars, which were spotted on a wooden, framed bent trestle. Between the bents and immediately under the floor of the trestle, V-shaped bins were built for the storage of aggregates. Three bins, two for rock and one for sand, were built, each of 50 cubic yards capacity and spaced a car length apart, bringing the dump bottoms of a train of cars directly over each bin. The trestle was built on a 1 per cent down grade toward the switch. A tail trestle, long enough for four cars, extended beyond the bins, supported partly on bents and partly on timber cribs. The space under the tail trestle was also used for ground storage of aggregates. Cars were unloaded into the bins by simply opening the bottom gates. By releasing the brakes the cars were moved along the trestle until the next car was spotted above the proper bin, ready for unloading.

Trucks backed into a shallow depression excavated under the bins and were loaded

COSTS OF HANDLING AGGREGATES FOR THE BUTTE-ANACONDA CONCRETE HIGHWAY WORK WERE REDUCED TO A MINIMUM BY HAVING THEM SHIPPED TO THE JOB IN STEEL HOPPER-BOTTOM CARS. TRUCKS WERE BACKED UNDER THE RECEIVING BINS AND LOADED BY GRAVITY

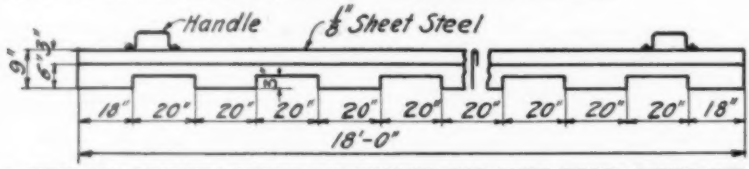
TO MAINTAIN THE SPEED IN CONSTRUCTION, EACH CREW HAD TO KEEP UP ITS END OF THE WORK. AFTER THE FORMS WERE IN PLACE THE TOP WAS CAREFULLY CHECKED WITH THE ENGINEER'S GRADE STAKE

by gravity through bin gates. Only one man was required to spot and unload cars and to keep a record of the materials received. The gates at the bottom of the hoppers through which the trucks were loaded were manipulated by the truck driver. About four cubic yards of material were loaded in less than one minute. Three of these loading plants were so spaced along the job that the average haul for all materials was 1.3 miles. The maximum haul was 2½ miles. In two locations the trestle was already on the ground. In the other a trestle was built by the contractor.

Aggregates were distributed on the subgrade by motor trucks. Wherever possible, the trucks hauled over existing roads or widened shoulders, rather than the newly constructed subgrade. Aggregates were placed on one side of the subgrade, leaving a clear working space of 6 feet. At the maximum haul of 2½ miles four trucks were used. As the haul shortened, some of these were released and used for other purposes.

A three-bag, Type E-14, Austin cube mixer was used. Each operation of the mixer was carefully studied and timed. It was found that the mixer could discharge a mixed batch in 12 seconds. It was also found that after the charging hopper was loaded, it required three seconds to bring the hopper into a position from which the material would fall into the drum. Accordingly, the mixer engineer anticipated the time required to bring the hopper into charging position and started to raise the hopper just three seconds before the drum was emptied. The entire operation of charging the mixer, mixing the batch and emptying the drum was often accomplished ine one minute and fifteen seconds, with a mixing period of one minute. Twenty-seven batches were required for each slab; to attain the average day's run of twelve slabs, each batch had to be loaded, mixed and discharged in less than a minute and a half.

Cement was shipped in by rail and stored in two warehouses so located as to afford the most economical haul. It was hauled to the mixer by motor truck and unloaded onto two small platforms mounted on wheels and placed on two sections of track. Each track section was long enough to accommodate both cement cars. As the mixer moved forward, the cement cars were pushed ahead with it, and when both cars were on the front section of track the back section was moved ahead. Cement platforms on cars were 4 by 8 feet and were about 2 feet above the ground. Each car held 100 sacks. Because the cement was on a raised movable platform, the work of picking up bags and emptying into the charging hopper was cut down to such an extent that this job was preferred by the workmen. Before the platform was put into service it was almost impossible to keep men for this task.



A SPECIALLY DESIGNED DEVICE FOR HOLDING THE JOINT FILLER WHILE THE NEXT SECTION WAS BEING PLACED. THIS HOLDER COULD BE EASILY REMOVED WITHOUT DISTURBING THE NEW CONCRETE

A SECTION OF COMPLETED CONCRETE HIGHWAY NEAR ANACONDA, MONT.
As a result of efficient methods and organization, 84,000 square yards of concrete were laid in 119 actual 8-hour working days

Aggregates were loaded into the charging hopper by wheelbarrows. As soon as the charging hopper was let down, the wheelbarrows had to be ready with the aggregates for the next batch. Crushed rock was hard to shovel, and nine men, three to each wheelbarrow, were employed shoveling and wheeling rock. Four men, two to each wheelbarrow, were employed on sand. The men took turns at wheeling and shoveling. Two men were required to load cement into the hopper.

A mixer engineer and a discharge man operated the mixer. Another man was employed part of the time firing the boiler and part of the time to help trim the subgrade. When the work stopped at noon and at night, the mixer drum was thoroughly cleaned. A number of cast iron balls about 2 inches in diameter were placed in the mixer, and the drum was rotated. The balls loosened the concrete adhering to the inside of the drum and the blades, and a stream of water washed out all the loose particles. Each morning before work was started the mixer was thoroughly gone over, and every evening any repairs necessary were made. The mixer engineer came on the job an hour before work was started and remained after the crew had gone, to keep the mixer in perfect repair. During the entire period of operation the mixer was never shut down for more than 30 minutes at a time, and because of the careful attention given the mechanical equipment, practically no time was lost on account of mixer trouble.

Eight men were employed placing concrete, three men spreading, two tamping, two finishing, and one spading concrete at the side forms and helping on the finished subgrade. Standard state methods of finishing were used. Elastite joints were spaced every 30 feet.

A specially designed joint holder was used and proved highly satisfactory. It was made of sheet steel, ⅛-inch thick and about 9 inches deep, with a ¾-inch lip doubled back at the top. Slots were cut in the bottom of the holder so as to enable the concrete in the new slab to come in contact with the joint filler. At each end of the holder a handle was welded to the top of the lip. The joint filler was placed in the groove formed by the slotted steel and the lip, and the device staked in place with steel pins across the subgrade. After concrete has been placed on both sides of the joint, the holder is easily lifted out by the handles on each end, leaving the filler in correct position with minimum disturbance of the fresh concrete.

To encourage individual effort among the workers, a bonus system of payment was inaugurated. At average efficiency the crew of 27 men was expected to put in a 30-foot slab every 53 minutes, or 9 slabs per 8-hour day. For a full day's run a bonus was paid for each slab over 9. If work was stopped at the end of 5 hours and

18 minutes (two-thirds of a day), a bonus was paid for each slab over 6 completed, the purpose being to fix the bonus for each slab placed and not only for a big run during an entire day's operation. For each slab placed above the required amount the sum of $12 was paid, to be distributed equally among the 27 men employed. The average day's run was 12 slabs, allowing a bonus of $36 for the 3 slabs over the 9 required in an 8-hour day. The maximum run was 13½ slabs.

Work was started June 5 and the entire job was completed October 25, a total of 139 days, during which time the mixer was operated on 126 days. Of the 13 days during which the mixer was not started, 8 were Sundays and holidays; one day was lost because of rain, one day because of a breakdown in the water system, and 3 days because of cold weather.

Daily records show that the following delays occurred on days when the mixer was started:

Material delays	2	hrs.
Mixer delays	7	"
Water-supply	1	"
Detour roads	3	"
Rain	21	"
Frozen pipe line	13½	"
Miscellaneous	8	"
Total delay	55½	hrs. or 7 days

Subtracting the 7 days due to delays from the total number of working days, the total actual working time was 119 days. In this time 84,000 square yards of pavement were laid, making an average run of 706 square yards for each day of 8 hours' actual operating time.

Results have proved the application of these methods entirely satisfactory. Progress has been rapid and steady. The pavement completed represented almost the maximum capacity of the equipment used. The time lost on account of shutdowns was very small because of the careful attention to mechanical equipment, and because of foresight and planning in supplying aggregates and coördinating the various operations at the different stages of the work.

Dumping Equipment for Road Contractors

Concrete Requires Special Attention in Handling

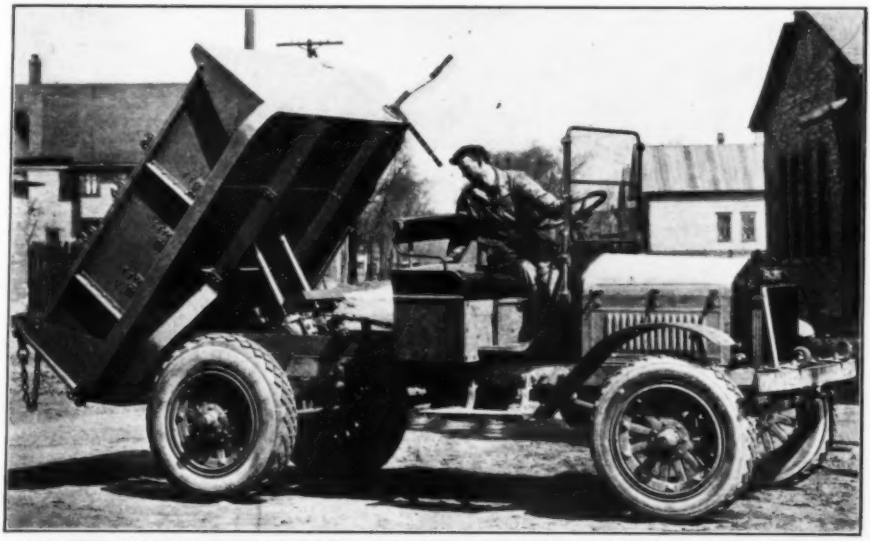
A POWER hoist which can give a dumping angle of 52 degrees attracts the attention of concrete contractors. The reason is simple: it is because that angle is sufficient to dump wet concrete, and with such a hoist one of their chief problems is solved. A new, patented Hydro-Hoist with long cylinders, made by the Heil Company, Milwaukee, Wis., is able to give a 52-degree dumping angle on many models of light-duty, short-wheelbase trucks. These light-duty, 2- to 3-ton trucks are equipped with pneumatic tires, which makes it possible for them to operate on the subgrade without cutting it up. They have a very short turning radius, which is indispensable for road work.

An "under-the-body" hoist is especially adapted for these short-wheelbase trucks, as its location beneath the chassis frame allows the body to be placed just back of the seat, thus utilizing all the loading space and giving proper distribution. The shorter the wheelbase, the more necessary it is to have an "under-the-body" hoist. Other advantages of using an "under-the-body" hoist are that it reduces the height of the body and facilitates loading. It also gives a lower center of gravity and makes the truck hold the road better.

The Hydro Hoist is considerably lighter in weight than other "under-the-body" hoists. This makes it possible for the truck to operate more efficiently on account of lower fuel consumption, less wear and tear on the tires and lower up-keep cost on the chassis. The hoist is compact, and the tank containing oil communicates directly with the cylinders, eliminating all piping as well as cables, pulleys and rollers.

The bodies which the Heil Company recommends for use with this hoist, are either standard or combination. The "3 in 1" combination body is equipped with mud-guards the full length of the body, double-acting tail gate and removable sides. The front and rear of the body are low enough to enable the driver to look back and see how the material is being loaded. The operating device is placed at the bottom, under the body, where it is protected from hard bumps. There are two handles to the operating mechanism. Should the driver desire to open the tail gate before the body is raised, he can do so. Should he desire to open the tail gate after the body is raised, the handle is still within reach.

The stake pockets in which the removable sides fit are 3 inches or more from the outer edge of the body, so as to give adequate protection to the sides. This also gives sufficient



A PARKER 2½-TON TRUCK EQUIPPED WITH HEIL COMBINATION BODY AND LONG CYLINDER HYDRO-HOIST PARTICULARLY ADAPTED TO STREET AND ROAD CONSTRUCTION, GARBAGE AND ASH HAULING AND STREET-CLEANING WORK

space for the driver to stand on the side of the body. Bodies are usually equipped with a chain spreader device, consisting of fork and chain. The links of the chain are fitted into the fork, allowing the tail gate to open the proper distance for spreading gravel or crushed rock or such other material as required.

Partitions are placed in the body so that several batches of material may be hauled. These partitions are removable and can be operated or tripped from one side. The operating device is simple and positive. It operates on the principle of an eccentric. When the handle is drawn backward the partition is raised high enough to clear the lugs, which are riveted to the bottom of the body. This allows the gate to swing forward. When the compartment is emptied, the partition swings back in position and the handle is turned down, thus locking the partition in place. This is a patented feature and sold by the Heil Company. Its special advantages are: first, it does not interfere with the flow of any material in the body; second, it can be operated by one man with very little effort; third, it is positive and substantial.

The style of standard dump body best adapted for road work is a square-cornered, straight-sided body with the front end crowned. It is made with square corners at the bottom so that brick, tile or other like material can be piled in closely. The sides should be straight so that every right-angle bend secures stiffness and rigidity. Straight sides cause the gravel to slide out evenly. The front should be crowned so that no material can spill over on the cab or truck. The tail gate should be double-acting so that it will serve a two-fold purpose. Under normal conditions it can be used as a standard dump body swinging out from the bottom. If a long body is desired, the top should be lowered to increase the loading space of the body.

In addition to the Hydro dumping equipment for use on large trucks, the Heil Company manufactures gravity bodies for light trucks. These bodies range in capacity from ¾ of a yard to 1½ yards for Fords, Maxwells, Chevrolets, Reos, etc. Dual hoppers of similar construction are used on larger trucks, as described in the June issue of the CONTRACTORS' & ENGINEERS' MONTHLY.

No Cut—No Building

Flat refusal on the part of building trades unions at St. Louis to accept a general 20 per cent wage reduction, or any suggested reduction, caused the Master Builders of that city to publish a communication advising the public not to undertake any construction projects "until such time as the workmen accept a wage that is more in harmony with general conditions as they now exist." Judging by the St. Louis newspapers, this action has stirred up a great deal of comment. The Master Builders say that $40,000,000 worth of new construction is held in abeyance on account of high costs. The wage dispute with the labor unions has been going on since January 1, and the employes have been impervious to all arguments for a wage scale based on payment of $1 an hour for skilled mechanics.—*A. G. C. Bulletin.*

The Value of Calculating Machines for Contractors and Engineers

By J. D. CLARK

PERFORMING calculations is pleasant work when the figuring is eliminated. The trouble has always been that there has been no way of eliminating the figuring and at the same time getting an accurate answer. Consequently, men have been forced to put in tedious hours obtaining answers and then checking up their work to be sure that the answers are correct.

Most engineering computations in themselves are more or less mechanical; that is to say, after the correct substitutions of figures have been made in long-established formulae, the actual solving of the resultant equations involves nothing more than the most rudimentary of arithmetical operations, namely, addition, subtraction, multiplication, division, and an occasional use of square and cube root.

These calculations take the greater part of the time occupied in the solving of any mathematical problem. The assembling of the figures involved is a small matter and quite readily accomplished, especially where the formula is one that repeated use has made familiar. In a problem that may require an hour's work, perhaps forty-five minutes will be expended in labor which requires only the ability and the patience to add, multiply and divide with accuracy.

To an even greater degree is this true in the case of the contractor where a large proportion of his calculations take the form of extensions—calculations very simple in principle but generally long and tiresome to perform.

The contractor's success or failure in securing a contract for proposed construction depends upon his ability to keep practical cost records for establishing unit rates, and upon the accuracy of which he estimates the amounts of material and labor required and extends them by the rates.

It is obvious that an error in any of these operations may either lose him the job by making the bid too high, or, what is very much worse, win it at a figure so low that it will be impossible to make a fair profit.

The whole situation simmers down to this: How are engineers and contractors going to obtain the complete and accurate figures which they require without enduring the everlasting drudgery involved in the routine work of figuring? The answer to this question lies in the calculating machine. This computing device adds, subtracts, mul-

A CONTRACTOR'S FIELD OFFICE WHERE THE WORK, PAY-ROLL AND OTHER DATA ARE CHECKED ON THE CALCULATING MACHINE

IN THE MAIN OFFICE, WHERE ESTIMATES AND ALL DETAILS OF EVERY JOB ARE QUICKLY CHECKED BY A SMALL OFFICE FORCE AND CALCULATING MACHINES

tiplies, divides, and extracts square and cube roots with surprising speed and absolute accuracy.

The up-to-date calculating machine handles all the actual figuring and permits the operator to devote his time to the analysis of his problems. The factors of the problem are put into the machine, and with a few turns of the crank the answer appears in the dials. The outstanding features are the immense savings in time and energy, but the comfortable feeling produced by a knowledge that the results are accurate is no small consideration.

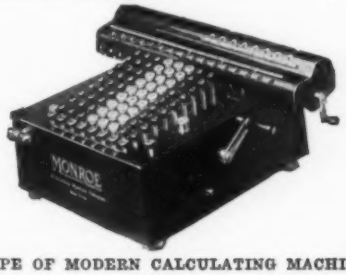
Simplicity characterizes the operation of the machine and especially recommends it to the engineer. Trained operators are not required; every man in the drafting-room can make use of it for his calculations. There are no roundabout methods or arbitrary rules to be adhered to, each operation is direct, and at every step the machine affords proof of the correctness of the calculation.

So many and varied are the calculations encountered in the engineering field, that heretofore every available assistance for the attainment of accuracy has been sought, including tables, slide-rules and logarithms. In particular has the slide-rule had an extensive use, even though by its aid only approximate results can be attained, while the placing of the decimal point has always been a bugbear. It is improbable that the slide-rule will be entirely displaced by calculating machines, but it will not be used as generously as it has been in the past.

In this connection it is interesting to note the recent experience of a Fall River engineer. In a letter, he writes:

"The calculators have given us a very pleasant surprise. We have been using slide-rules for years and felt that there was nothing quicker or more convenient for our line of work.

"The time came when we required a greater accuracy than a 20-inch slide-rule would give us, so we decided to try Monroes on this special work. We had not been using them for more than a few days when we realized that they could do most of our work very much quicker than the slide-rules and with perfect accuracy. Although there is a slide-rule on nearly every desk, it is surprising to see how seldom we use them."



TYPE OF MODERN CALCULATING MACHINE

Science and civilization owe a great debt to logarithms. One might look upon them as having afforded emergency relief for three centuries, but it is so much easier to employ the tables of natural functions and multiply directly on the machine than to employ tables of logarithms.

ACKNOWLEDGMENT.—Illustrations by courtesy of Monroe Calculating Machine Company, Woolworth Building, New York City.

Stone-Spreading Attachment for Motor Trucks Replaces Most Hand Labor

CONTRACTORS who unload stone from a truck in the old way of simply tipping the truck and running along the subgrade, are familiar with the way the stone packs unevenly and in wavy piles. Under such conditions the only way to determine the dumping-place is to guess at it. Every contractor finds after the stone is scattered the full width, that he is compelled to shovel the surplus at one place into a wagon and haul it some distance down the road to a place where there is not enough stone. This means extra expense and loss of time.

The Burch Plow Works Company, Crestline, Ohio, has developed a machine to be attached to the rear of a motor truck to readily control the rate at which stone is distributed on the road. By attaching this machine to a truck, an even depth of stone is distributed. The thickness of stone is regulated by raising or lowering the gate on the rear of the machine. This machine is 7 feet 4 inches long, so that it can be used with any truck. The width of most roads is such that it permits the truck to drive up and down twice, so that stone can be spread the entire width, leaving very little work to be done by hand. Even if the road is narrow and will permit only a single trip, there is very little to be done after distributing the rock through the center with this machine, as one has only to drag the stone out a couple of feet on either side. In this way the contractor is absolutely sure that he has the right amount of stone on the road; and as this is automatically regulated, after the machine is once set there is no need of hauling stone from one place to another.

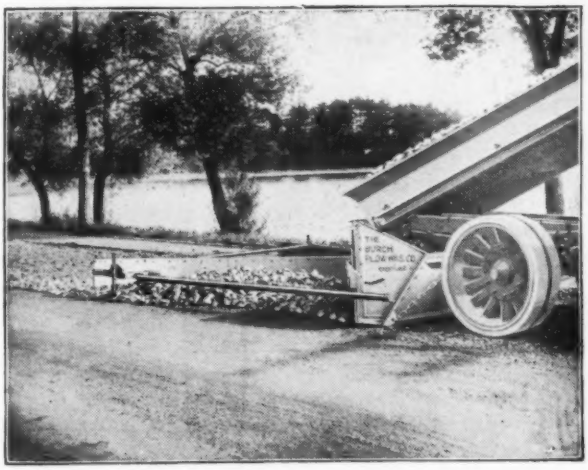
In order to enable the contractor to spread his stone the entire width of the road and to do this without extra labor, a wing attachment has been devised to be added to the regular Burch stone spreader. By the use of these wings it is possible to get the correct amount of stone on the road and spread it to practically the full width. The principle is the same as stroking a half-bushel measure to get the right amount. Adjustment is provided for in width of spread on these wings by pushing the braces forward or backward, and the side brace telescopes so that it can be adjusted to correspond with the adjustment between the wings.

A shoe at the side makes it possible to raise or lower the wings to regulate the thickness of stone on the road. A crown can be given by raising the wings higher in the center than at the end. When the wing attachment is used, the

THE OLD AND UNCERTAIN METHOD—DUMPING STONE ON THE ROADWAY DIRECTLY FROM THE TRUCK

gate on the rear of the box must be so adjusted that just enough stone will come through to spread the proper thickness and run the entire length of the wings. In spreading around a curve or a corner where more stone will be required on one side than on the other, the gate can be raised higher on that side, permitting the required amount of stone to pass through.

Because of the uniformity of spreading the stone by these combined machines, they are great savers of material as well as labor. A contractor who has used one of them to build several miles of road, claims he saved enough stone in two miles to pay for his machine, not taking into consideration the saving in labor, and he still met the specifications to the entire satisfaction of the engineer. This is because of the accuracy with which the machine gets the proper amount of stone on the road.



THE SPREADER ATTACHED TO TRUCKS ECONOMIZES IN STONE, LABOR AND TIME

The Value of Small Tractors in Road Work

WHEN a tractor will clear the route of a new road, plow out the rocks, roots or old road-bed, pull heavy loads of material through deep mud, handle the drag, grader and scraper, the contractor will save money by its immediate adoption in place of horse or mule power. With such a tractor on the job, most of the bad-weather tie-ups are eliminated. The broad metal tracks of the modern light-weight tractor give sure traction or power over rough roads and through sand and mud where horses or trucks are useless. The tractor can work more days, does more work each day, and does not cost anything when it is not busy. Tractors of this type now do the work which horses, trucks and stationary engines have done for contractors.

The Cleveland Tractor Company, Cleveland, O., manufactures the Cletrac, which is claimed to be a medium-weight tractor of the type most needed by contractors in road work. Tests of the Cletrac's pulling power demonstrate its ability to work steadily. This, taken with the amount of material which can be moved in a day, the yardage excavated with scoop or wheel scrapers, the miles graded or dragged, show that the Cletrac does the work of between 6 and 8 horses or mules and at lower cost.

To insure traction and pulling power under the unusual conditions of deep, slipping clay or frozen ground, sometimes encountered, a special road-work track with hard, ground-gripping grouters has been designed for the Cletrac. The motor of this tractor is a 4-cylinder, 4-inch bore, with 5½-inch stroke, with protected overhead valves and a removable cylinder head. Twelve horse-power is developed at the draw-bar, with 20 at the belt pulley. The machine has a pull of 1,500 pounds at 3½ miles per hour, which is its normal speed. The control permits it to operate from 1 to 4 miles per hour. The total weight of the machine with fuel is 3,420 pounds, or about 4¼ pounds per square inch of tractive surface. The belt pulley is 8 inches in diameter with a 6-inch face.

The Origin and Use of the Steam Pile Hammer

PILING or sheeting is driven faster by lessening the friction between the outside surface of the work and the material into which it is being driven. It is only in recent years that engineers have given any serious thought to this subject of reducing friction.

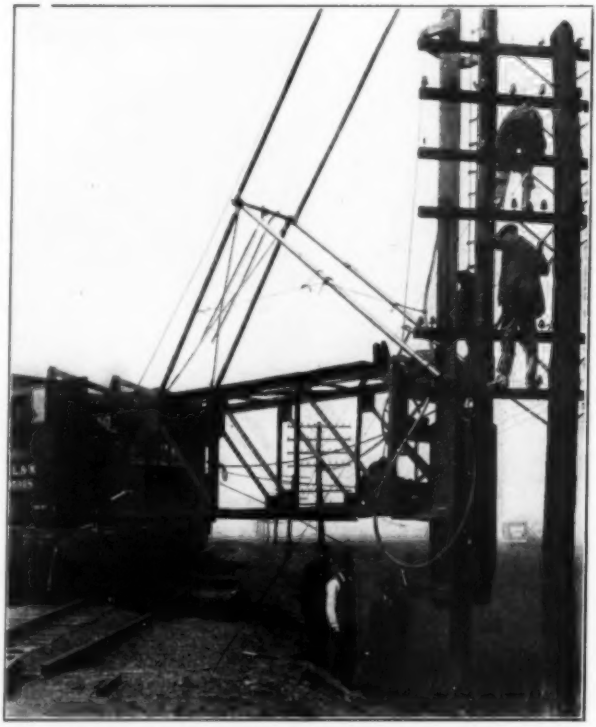
The first step in this direction is well within the memory of a few contractors still on the job. The story is told how a young engineer working on a project down in Mexico, was resting during the midday period and was amusing himself by dropping from his hand a fine stream of sand onto his trousers. While he was thus employed, so the story runs, an earthquake caused his trousers to vibrate and the sand was shaken to the ground. He noticed further that it was quite impossible for the sand to stick to his trousers during the quake, because they were constantly in motion.

He conceived an idea: he knew that between the blows of the old pile hammer he was using, fine particles of sand were sifting into every pore, crack and crevice of the pile, increasing the friction and therefore lessening the distance which the pile would drive at each blow. He realized that if he could find a way to keep the pile constantly in motion he would lessen friction, because then small particles of earth would have no opportunity to settle tightly around the work.

This engineer set to work and soon designed and constructed a crude steam hammer which delivered blows more rapidly than his old rig. Since that day, steam hammer development has been rapid, until now there may be obtained the hammer which delivers as many as 400 powerful blows per minute. This hammer, of course, keeps the work constantly in motion and thereby lessens friction through keeping the earth around the pile alive by the constant downward motion.

Some may believe that such rapidity of powerful blows will shake a hammer to pieces in short order, but actual experience gives proof to the contrary.

For example, the Delaware, Lackawanna & Western Railroad three years ago purchased from the National Hoisting Engine Company, Harrison, N. J., a National No. 1 pile hammer for use on its combination wrecking and pile-driving car, shown in the illustrations. This hammer was first put to work three years ago driving 60-foot piling, 14-inch butt, into stiff material at Convent, N. J. It has been working constantly ever since, delivering blows with great rapidity and driving at high speed. When the photograph shown here was made, a few weeks ago, the same hammer was driving 25-foot piling and was working with the same positiveness that it showed the day it was bought.



A THREE-YEAR-OLD NATIONAL PILE HAMMER IN DAILY USE ON THE D. L. & W. RAILROAD

There are many other instances of hammers of this type that have been operated constantly at high speed for periods greatly in excess of three years. All such practical demonstrations prove conclusively that when a hammer is designed and built to be operated at, say, 400 blows per minute, it will stand up remarkably well. This National hammer will drive piling or sheeting at an unusually high rate of speed simply because the rapidity of its blows keeps the earth alive and reduces friction.

Why Contractors Lose Money

They Must Specialize and Use Proper Equipment to Succeed—Motor Trucks Essential

By MAX CUNNINGHAM
Formerly Chief Engineer, Oklahoma State Highway Commission

ONE of the first things any highway contractor must do is to forget that he ever did any work other than highway jobs. This comes from the fact that many highway organizations are made up of men with considerable experience in railway work who will be big losers until they can forget this fact.

The engineer locating a railway is bound by definite limits of grade and curvature, controlled in turn by actual or estimated tonnage requirements, and affected only generally by local topography.

Highway and Railroad Engineering Differ

Highway engineers do not have to figure on draw-bar pull, train tonnage, or wear of track, and while they have certain arbitrary ruling grades and curves to govern them, these are usually so liberal that a general statement may be made that "a highway profile means nothing to a contractor." This is a rather broad statement, but a little consideration will show how true it may be. No railway will break a tangent or exceed its "virtual" profile to dodge a rock cut, but it is done every day in the field of highway work. Compensation for distance is common railway practice, rise and fall of grade has a definite tonnage value, but the scenic appeal of a highway frequently causes things to be done that are absolutely foreign to the railway engineer and his contractors.

Consideration of this statement will cause one to realize that "quantities" in highway grading come almost entirely from the width of the crowns, and on most jobs the only real grading is across stream bottoms where material is mostly undesirable. For these reasons it is necessary to build up an entirely different line of "subs," and one should be particularly careful to figure in bids, and in dealings with sub-contractors, to include enough for finishing—and then double it.

The job that would be entirely acceptable to a competent resident engineer will probably be unsatisfactory to the local critic, and you must figure on him.

I have also found that many bidders on general contracts fail to sufficiently estimate the cost of "extensions" to existing structures. Bids made on unit basis for considerable quantities of masonry are frequently figured on an "appearance" basis, and the builder finds he has "end walls" and "extensions" where the total price received for the units built will not pay for the expense of getting the men to the job. This may be balanced by the price received for the volume of work, but too frequently must be carried as a loss against a part of the work that cannot carry at a loss.

Mules and Trucks as Equipment

The question of adequate plant is one that is important enough to call for a paper in itself, but my advice would be for the highway contractor to specialize.

Too many men have lost by using mules they had, rather than invest in motor trucks that would have saved and earned money. The reverse has frequently occurred. In these days of scarce and inefficient labor and eager and inefficient bidders, no one should undertake work unless he is satisfied that he is equipped or able to equip to handle it economically. Plant study, with the aid of a real expert, would pay anyone, and where he has secured proper plant and efficient and satisfactory organization, he should bid on only such work as he is ready to build right.

The Contractor's Duty to the Public

The things mentioned are all of great importance, but the highway contractor should never lose sight of the fact that he is dealing with the public and not with a private or public service corporation. Particularly, he should study the specifications, for the balance of his contract can only be interpreted with them as a key.

He should study the men in charge of the work, and then discount that study, for the average highway engineer is not selected for his ability, but for his friends. No matter how good the man may be, he is liable to lose out at any time, and it is almost a certainty that he cannot dictate who shall be employed. In many cases his appropriations are so small that he cannot keep good men if he has them.

These factors have a great bearing on the financial success of the contractor, and must be considered carefully in making bids.

Most contractors realize now that they should get all of a contract, so as to be in a position to coördinate the various steps, but do not forget that the policy of most highway departments is to increase the size of jobs, so as to have fewer men to deal with, and most contractors encourage them, hoping to be fortunate enough to land one of these real jobs. This is the most dangerous of policies, and, while it may ultimately lead to permanent organization of non-political highway departments, this day is quite a way off, and the highway will be strewn with "busted" contractors.

Pick One-Season Jobs to Build Right

My earnest advice to every highway contractor would be to pick the job he wants, organize to build it right, and quickly, and never to take on a job that will take more than one season to build.

A chief engineer and all his help are employed by a great public and are subject to all kinds of criticism (mostly unfriendly) and contractors are paid by the same public. A private corporation is willing for a contractor to make money at its price because he will be a better man for the next job. It is most unfortunate that the unreasoning public is inclined to think and claim "graft" if a contractor works for a profit. The man who has his money in plant and job has too many chances to suffer if his work goes over two or more seasons.

From an address presented at the National Conference of Associated General Contractors, New Orleans, La.

A Valuable New Method for Ditching

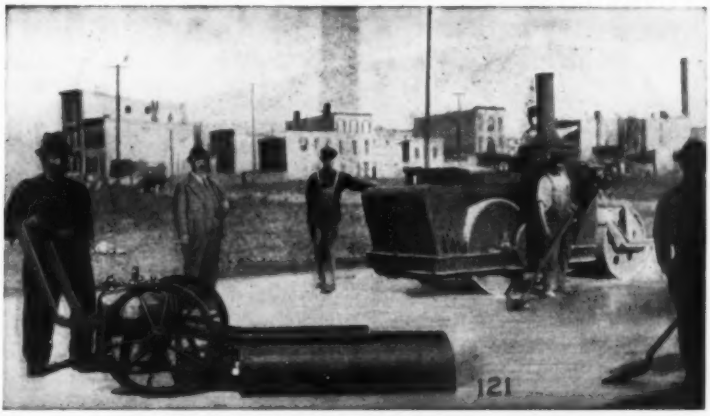
SINCE the war, when a great many ditches were blasted with dynamite because of the shortage of labor and the necessity for speed, the method has been quite popular with contractors who are familiar with it. As a general thing the propagated method of blasting has been preferred, because thereby is saved the time of priming all bore holes in the line of the shot and the time of wiring up the charges. However, a propagated shot requires the use of straight N. G. dynamite, and because it freezes and chills at a comparatively high temperature, it has been possible to use it successfully for propagated ditch blasts, especially in the North, only during the five warm months of the year, thus causing considerable inconvenience.

But now the discovery has been made by the laboratories of E. I. Du Pont de Nemours & Company, Inc., of a formula for making a low-freezing straight N. G. dynamite. It is anticipated that the use of this new explosive will extend the period during which propagated blasting may be successfully done, to eight or nine months of the year.

As everybody knows, February is a cold month in northern Minnesota. In order to test the new dynamite, some of it was used on February 21 on a ditch that was being blasted by the St. Louis County Engineer. The dynamite had been stored all winter in a Duluth magazine in the original unopened cases. Ordinary straight dynamite would have been frozen solid under the circumstances, but when taken from the box, this low-freezing dynamite was soft and in perfect condition for immediate use in spite of the fact that the temperature a week previously had been 18 degrees below zero, and there had been no weather intervening that would have caused thawing had the dynamite been frozen.

As used on the county ditch, it was loaded into wet, cold soil in bore holes drilled through 24 inches of frozen ground. The temperature of air and water at the time was about 30 degrees above zero. The frost was not thawing. The shot propagated perfectly. In spite of frozen soil down to a depth of 18 to 24 inches, a ditch 9 feet wide and 2 to 2½ feet deep resulted.

To prevent an uneven, jagged bank line, notches or small trenches were cut where it was desired the side lines should be. The only cleaning necessary after the blast, consisted in lifting out some chunks of frozen soil that fell back in the ditch. The foreman in charge of the work stated that the new dynamite gave them the cheapest yardage cost of any ditch they have ever put through in St. Louis County in winter.



USING THE HEATER ON ASPHALT ROAD REPAIRS

Kerosene Heaters for Road Departments and Water-Works

THE asphalt surface heater shown in the accompanying illustration is used by many contractors in place of old-style, poorly balanced equipment. It is constructed in two sizes, with hoods 28 by 48 inches and 47 by 72 inches. The hoods are of a uniform height of 20 inches over-all. The burners of this improved heater are so arranged that the intense flame does not strike the pavement abruptly, which causes the immediate surface of the asphalt to burn, taking the life completely out of it. The new arrangement provides for a gradual heating of the asphalt downward, evenly permeating the material to the concrete base.

The hood is so connected to the frame that it can be quickly and easily detached for transportation. Provision is made by means of a bridge arrangement to support the center of the outfit, avoiding any unnecessary strains at this point. The whole outfit is well balanced, so that it can be easily handled with a minimum of effort by one man.

The makers, the Hauck Manufacturing Company, 126 Tenth Street, Brooklyn, N. Y., have equipped a number of contractors and city departments with these heaters, and the reports indicate that they are doing the work efficiently in the quickest possible time and at the lowest fuel and labor costs.

This concern is also producing an exceptional time- and labor-saving tool in the lead melting furnace and portable heater shown in the second illustration. This furnace has a capacity for melting 450 pounds of lead in 20 minutes and keeping it molten at a cost of but a few cents per hour.

Like the asphalt heaters above described, it burns kerosene, doing away with the handling and chopping of wood.

The portable burner (with lengths of hose varying to meet individual requirements) is admirable for burning lead out of joints.

The No. 22 Hauck lead melting furnace and portable heater described above has been adopted as standard equipment by many leading contractors and water-works.

MELTING LEAD FROM WATER-MAIN JOINT

Triplex Pumps in Road Construction

CONCRETE roads and water-bound macadam roads require a great deal of water in their construction. The water-supply is often at quite a distance from where it is needed, and to get it to this point at all times for the mixer and for sprinkling the newly laid road requires a dependable and efficient pump. To meet the demand for a pump that is good for a higher pressure and capable of delivering water over a longer distance and to a higher elevation than the regular piston force pump, the C. H. & E. Manufacturing Company, Clinton and Mineral Streets, Milwaukee, Wis., has developed a line of gasoline-driven triplex pumps. In the design of these outfits each part is proportioned to reduce operating troubles to a minimum and to make frequent adjustments unnecessary. The bearings, connecting rods, valves and glands are all accessible for occasional inspection and adjustment.

These pumps are direct-geared to gasoline engines, making the constant attendance of an operator unnecessary. The gears are all machine-cut and of ample size to stand very severe strain. A relief valve set at the maximum working pressure of the pump is furnished with each outfit, making it impossible to wreck the pump in case water becomes obstructed at any point in the pipe line.

The illustration herewith shows a vertical-type, kerosene-engine-driven, dual-system triplex pump. This consists of two complete triplex pumping outfits mounted on a single truck, operated independently of each other, which provides a positive guarantee that the concrete mixer will be supplied with water and that there will also be sufficient water for watering down the road.

By alternating the operation of one pump in the morning and the other pump in the afternoon, the pump operator has a chance to go over the pump which is not working and keep the outfit in perfect running order. This 4-cylinder, engine-driven triplex pump outfit is better than a steam pump in that it does not require the services of a licensed engineer and does away with the expense of coal and its attendant haulage problems. It is far more easily portable than a steam pump and can be started immediately. The construction of the frame is such that there is practically no vibration when either pump is operated. The plungers of the triplex pump are outside-packed; and since they are operated in a vertical position they are not affected by dirty water, as is the case with horizontal plungers.

A DUAL PUMPING OUTFIT WITH GOULD TRIPLEX PUMPS FOR ROAD WORK

Sand and Gravel Rates

THE National Sand and Gravel Producers' Association sees no hope for a general relief in the way of freight reduction this year.

There are a few instances where the railways have made local readjustments, the latest being in New Jersey, where a court decision requires a lowering of rates of about 18 per cent on this commodity, within the state. Other local rate reductions have been made in Wisconsin and in Kentucky, but these were not general in their nature.

GET THESE GOOD CATALOGS

The catalogs and pamphlets listed below are available for free distribution. Contractors and Engineers who check over these pages each month and write for such material as interests them, will find this a valuable means of keeping up to date on the subject of machinery and equipment.

PORTABLE UNLOADING EQUIPMENT
Complete specifications and prices for immediate delivery of Fairfield portable equipment for unloading cars, which saves the contractor from $8.50 to $9.50 per car, may be secured by writing to the Fairfield Engineering Co., Lancaster, O.

MOTOR TRUCKS FOR CONTRACTORS
The Federal Motor Truck Co., 34 Federal St., Detroit, Mich., has issued an interesting folder showing the value and uses of Federal trucks in all types of contracting work.

YOUR NEEDS IN USED EQUIPMENT
Forsythe Bros., Hudson Terminal Bldg., New York City, have a complete list of used equipment in locomotive cranes, auto cranes, concrete mixers, industrial railway cars and hoisting engines which they stand ready to send to any interested contractor needing equipment of this type on the job at once.

ROCK DRILL HOIST AND COMPRESSORS
The Denver Rock Drill Manufacturing Co., Denver, Colo., will be glad to send its literature on Waugh rock drills, drill sharpeners, hoists, and compressor outfits, specially adapted to contractors' work.

UNIVERSAL CAST IRON PIPE
The advantages of Universal cast iron pipe, laid solely with the help of a wrench, may be found in the literature of the Central Foundry Co., 90 West St., New York City.

CUTTING ROAD MAINTENANCE
The use of the Cletrac in road building and maintenance may be further appreciated by contractors and engineers if they will write to the Cleveland Tractor Co., 19211 Euclid Ave., Cleveland, O., for copies of its latest bulletins on the Cletrac in road work.

SPECIALS IN USED EQUIPMENT
The up-to-date list of used equipment of the Frank T. Craven Co., 46 Church St., New York City, will be of benefit to many contractors looking for specific equipment to fit a certain job.

GASOLINE LOCOMOTIVES FOR ROAD WORK
The latest literature of the Cummings Machine Co., Minster, O., contains details regarding the use of Cummings gasoline locomotives on some of the biggest road jobs in the country.

ALL TYPES OF NEW AND USED WOOD TANKS
The Curtiss-Willis Co., 30 Church St., New York City, dealing exclusively in steel and wooden storage tanks, both new and used, will be glad to send its literature to any part of the country.

SHOVEL ATTACHMENT FOR EXCAVATOR CRANES
Pawling & Harnischfeger have just issued a new bulletin, SX, describing their shovel attachment for use with standard P. & H. type 205 and 206 excavator cranes. Copies of this pamphlet may be secured gratis by contractors upon writing to the Excavating Machinery Div., Pawling & Harnischfeger Co., Milwaukee, Wis.

PORTABLE COMPRESSED-AIR OUTFITS
Bulletin P. C. 1, issued by the Rix Compressed Air Drill Co., 505 Howard St., San Francisco, Calif., describes in detail Rix pneumatic combination outfits for supplying compressed air for road jobs in various sizes suitable for one or more pieces of pneumatic machinery.

BUILDING ASPHALTIC CONCRETE ROADS
The Asphalt Sales Dept. of the Texas Co., 17 Battery Pl., New York City, has just issued a new booklet, "Texaco Asphaltic Concrete," which answers the plea of the engineer, municipal official or contractor, "Tell me how to do it, and make it short."

FREE SAMPLE OF MAP REPRODUCTION
The Lithoprint Co. of New York, Inc., 41 Warren St., New York City, will be glad to send copies of its 8-page booklet, describing the Lithoprint process of producing correct facsimiles of tracings, maps and plans and including free samples of maps reproduced by this process on heavy paper, heavy cloth, thin cloth and tracing cloth.

SELF-LOADING SCRAPERS FOR ROAD WORK
The Baker Manufacturing Co., 503 Stanford Ave., Springfield, Ill., makers of Maney self-loading scrapers, which dig, load, haul, dump and spread, will be glad to send descriptive literature to contractors and engineers on request.

LONG-LIVED ASPHALT KETTLES
The Iroquois line of asphalt kettles described in Bulletins 8, 6 and 5 of the Iroquois Sales Department of the Barber Asphalt Paving Co., Philadelphia, Pa., contain much information of interest and value to the paving and roofing contractor.

A SUPPLEMENTARY MIXER CATALOG
The Koehring Machine Co., Milwaukee, Wis., has just issued a supplement to its extensive 1920 concrete mixer catalog, which contains much additional information regarding the capacities of Koehring mixers on road and building jobs.

ROAD ROLLERS—MOTOR AND STEAM
The Austin-Western Road Machinery Co., Chicago, Ill., in its new catalog F, describes in detail the various types of Austin rollers, including single- and double-cylinder motor rollers, steam rollers, tandem rollers and scarifiers.

AN ALL-ROUND STEAM SHOVEL
The various qualities of the Marion "21" steam shovel, with its ease in handling, which keeps wagons and trucks on the move and which is built with either steam, gasoline or electric power, are described in detail in the latest bulletin of the Marion Steam Shovel Co., Marion, O.

HIGH-GRADE LIQUID CHLORINE
The Technical Department of the Mathieson Alkali Works, Inc., 25 West 43rd St., New York City, will be glad to advise any engineers and officials on the use of liquid chlorine, chloride of lime or soda ash in solving municipal water sterilization or softening problems.

A MOTOR TRUCK ROAD BUILDER
The GMC road builder, a specially equipped motor truck with a capacity of one yard of concrete or other material, is described in detail in a folder which may be secured from the General Motors Truck Co., Pontiac, Mich.

A COMPLETE LINE OF ROAD MACHINERY
The Good Roads Machinery Co., Inc., Kennett Square, Pa., will be glad to send its catalogs of road graders, tandem and macadam steam rollers, road drags, oiling machinery, tar kettles, dump-wagons, sprinklers, sweepers and culvert pipe, as well as rock crushers and elevators, to any interested party.

(*Continued on page 62*)

(Continued from page 61)

FREE ROAD DATA IN POCKET FILE
The National Steel Fabric Co., 909 First National Bank Bldg., Pittsburgh, Pa., has just put out a pocket file for holding and preserving papers and documents, which it will gladly send free on request to contractors, engineers and officials.

HIGH-GRADE ROAD MACHINERY
The descriptive matter of the Acme Road Machinery Co., Frankfort, N. Y., describes in detail the Acme line of road-building machinery for every purpose.

STONE SPREADERS SAVE MONEY
A stone spreader which automatically spreads the stone as it is dumped and distributes it uniformly to any depth, is described in descriptive matter which may be secured from Department K6, the Burch Plow Works Co., Crestline, O.

DUMPING EQUIPMENT FOR EVERY NEED
The Heil Co., 1243 26th Ave., Milwaukee, Wis., has placed on the market a gravity-dump body for mounting on short wheel base trucks at a remarkably low price.

STEEL FORMS FOR ROAD JOBS
Heltzel steel forms for concrete road work are easily set up and taken apart. Full details regarding their uses and how they speed up construction work may be secured by writing to the Heltzel Steel Form and Iron Co., Warren, O.

PRESSURE DISTRIBUTORS FOR ROAD WORK
Full details regarding the advantages of the Kinney auto heater and distributor for heating and applying under pressure all varieties of bituminous material, hot or cold, for road construction, maintenance or dust laying, may be secured by writing to the Kinney Manufacturing Co., 3529 Washington St., Boston, Mass.

PORTABLE CONCRETE MIXERS
Full details regarding the specially designed Wolverine mixers, which are strong and readily portable, may be secured by writing to the Knickerbocker Co., 338 Liberty St., Jackson, Mich.

STEAM PILE HAMMERS
The record work of the various sizes of McKiernan-Terry double-acting steam pile hammers is described in detail in the literature of the McKiernan-Terry Drill Co., 19 Park Row, New York City, which may be secured free on request.

UP-TO-DATE WATER METERS
The Neptune Meter Co., 50 East 42nd St., New York City, will be glad to send to interested officials and engineers its latest literature describing the advantageous features of the Trident meter, including the enclosed gear train.

ENDURING DRAINAGE CULVERTS
The special features of Newport corrugated metal culvert are described in the latest illustrated literature of the Newport Culvert Co., 542 West Tenth St., Newport, Ky.

HOISTING ENGINES AND PILE HAMMERS
The new catalogs of the National Hoisting Engine Co., Harrison, N. J., describe in detail National hoisting engines, from the smallest to the most powerful, and the advantages of National hammers, the work of which is accelerated by steam or air, assisted by gravity.

THE SAFE STORAGE OF EXPLOSIVES
Littleford Bros., 500 E. Pearl St., Cincinnati, O., have issued a small booklet bearing the above title, describing their various types and sizes of powder magazines for the protection of explosives on contracting and building jobs.

MIXERS FOR CONCRETE ROADS AND WALKS
Progressive contractors interested in getting all possible out of the concrete mixer should write to the Jaeger Machine Co., 213 Dublin Ave., Columbus, O., and ask for the latest literature on its special line of mixers.

STEEL CONCRETE MIXERS
Bulletin No. 10 C-E, issued by the Gray Iron Foundry Co., Reading, Pa., describes in detail its Keystone all-steel mixers of the 10-cubic-foot power-loading type, 10-cubic-foot low-charging type, and 6-cubic-foot half-bag type.

OIL-BURNING EQUIPMENT FOR CONTRACTORS
The special bulletin of the Hauck Manufacturing Co., 132 Tenth St., Brooklyn, N. Y., describes in detail Hauck oil-burning equipment for contractors, including lead-melting furnaces, asphalt surface heaters, kettle heaters for tar, asphalt and pitch, lights and kerosene torches in all sizes.

CLAY, SAND AND GRAVEL DIGGERS
An interesting pamphlet describing a low-priced, one-man-operated shovel for use in digging and loading or light excavation of any sort, and one which can be used with either shovel-type dipper or clam-shell bucket, will be mailed on request to the Bay City Dredge Works, Bay City, Mich.

DEPENDABLE EXPANSION JOINTS
Full particulars regarding Carey Elastite expansion joints, which always remain tight and which save the road from destruction by absorbing the expansion and contraction, may be secured from the Philip Carey Co., 9 Wayne Ave., Lockland, Cincinnati, O.

SURFACE HEATERS FOR ASPHALT REPAIRS
The Lutz surface heater, which softens asphalt and other bituminous pavements which are to be renewed or patched, is described in detail in the illustrated catalog of the Equitable Maintenance Co., 1901 Campbell St., Kansas City, Mo.

LUMBER FOR BRIDGES AND STRUCTURES
If you are in need of lumber for bridge planking and structural work, full information may be secured from the Sargent Lumber Co., Little Rock, Ark.

USED EQUIPMENT IN RECENT MODELS
The Grey Steel Products Co., 111 Broadway, New York City, specializes in new and slightly used equipment of most recent models of contractors' equipment. This company will be glad to send its list of equipment ready for immediate sale and shipment.

A SCOOP BODY FOR LIGHT TRUCKS
The Easton Car and Construction Company, Fulton and Church Sts., New York City, has described in its latest literature the new Easton scoop body for Ford trucks. This new body can be attached and detached in ten minutes and is the only one of its kind on the market.

RELIABLE ROAD MACHINERY
The complete line of Reliance road building and quarrying equipment manufactured by the Universal Road Machinery Co., Kingston, N. Y., including crushers, elevator screens, bins, sweepers, scarifiers, oilers and car unloaders, is described in its catalogs and price lists, which may be secured free on request.

THE STANDARD LINE OF EQUIPMENT
Catalog No. 69, issued by the Standard Scale and Supply Co., 1631 Liberty Ave., Pittsburgh, Pa., describes the varied uses of the Standard line of concrete mixers, street pavers, hoists, pumps, gas, gasoline and oil engines, material elevators, spouting equipment, wheelbarrows, etc.

STEAM SHOVEL PERFORMANCE
Full information and catalogs regarding the performance of Thew power shovels in all types of soil, together with specifications and prices, may be secured from the Thew Shovel Co., Lorain, O.

PROTECTION WITH CURB BARS
The value of Truscon curb bars to protect and reinforce concrete curbs and the reasons why they are strong, rigid, convenient and easy to instal, are given in literature which may be secured from the Truscon Steel Co., Youngstown, O.

RELIABLE GAS AND OIL ENGINES
The particular advantages and many uses of Novo gas and oil engines in all types of contracting work are described in detail in the literature of the Novo Engine Co., 848 Porter St., Lansing, Mich.

SPEEDY CLAM-SHELL BUCKETS
The advantages of the Type "O" Owen clam-shell bucket for the economical handling of stone and other building materials from cars, are described in the latest bulletins of the Owen Bucket Co., 418 Kirby Bldg., Cleveland, O.

CONCRETE MIXERS FOR BUILDING WORK
The Ransome Concrete Machinery Co., 1772 Second St., Dunellen, N. J., describes in its Bulletin 104 the mechanical reasons for the extensive use of Ransome mixers in both road and building work.

INDUSTRIAL EQUIPMENT SPEEDS ROAD WORK
The descriptive bulletins and catalogs of the Koppel Industrial Car and Equipment Co., Koppel, Pa., will tell you why contractors are speeding up their work by the use of Koppel standard equipment.

CONTRACTORS', ENGINEERS' AND MANUFACTURERS' NOTES

Fire Damages Heltzel Plant

The plant of the Heltzel Steel Form and Iron Company, Warren, Ohio, was partly damaged by fire on Thursday, June 2. The Steel Fabricating Department suffered most from the damage, so that shipments of steel were held up for a short time after the fire. This department, however, has continued operation almost uninterruptedly since the fire. Because of its present road-building campaign throughout the country, the Steel Form Department was very busy at the time of the fire, and it is very fortunate that this department was not damaged to any great extent.

Smith Becomes Assistant Professor

Herschel C. Smith, formerly Deputy State Highway Engineer of Oklahoma, has been appointed Assistant Professor of Highway Engineering and Highway Transport at the University of Michigan, from which institution he graduated in 1913. Last October, Mr. Smith was elected Roy D. Chapin Fellow in Highway transport at the University, and in June received the degree of Master of Science in Highway Engineering and Highway Transport.

Connery Rebuilds Plant

Connery & Company, 4000 North Second Street, Philadelphia, Pa., have just completed the reconstruction of their plant after its partial destruction by fire and are now on a production basis again, having a stock of over 600 kettles of all styles, ranging in capacity from 10 to 500 gallons. All Connery heaters are double electrically welded throughout and are guaranteed not to leak. A few of the styles are also constructed with the new patented steel rib, which has eliminated buckling sides on certain types of construction.

To Report on Waste Disposal

Samuel A. Greeley, well-known consulting engineer and a member of the firm of Pearse, Greeley and Hansen, 39 West Adams Street, Chicago, Ill., has been retained by the city of Akron to investigate and report on rubbish collection and disposal.

Link Belt Company Expands

The entire capital stock of H. W. Caldwell & Son Company has been acquired by the Link Belt Company, Chicago, Ill., and Frank C. Caldwell has been elected a director of the Link Belt Company.

New Orleans Office of Brown Co.

Charles H. White has been appointed Manager of the new New Orleans office of the Brown Hoisting Machinery Company, Cleveland, Ohio.

P. & H. Moves San Francisco Office

Pawling & Harnischfeger Company, Milwaukee, Wis., announces that the San Francisco office of the company has been moved from the Monadnock Building to 32 Beale Street, where the company maintains a complete service station warehouse and display room for crane and hoists, machine tools and excavating machinery. R. M. Taylor, District Manager for Pawling & Harnischfeger on the Pacific Coast, has his headquarters at the Beale Street address. J. MacFerran Taylor is a new member of the Pacific Coast Sales District.

New Sales Organization

Offices have recently been opened in Philadelphia by the John A. Conboy Company, a new organization handling the sale of contractors' machinery and equipment in the railroad, mining and industrial field.

Good Roads Machinery Moves

The Good Roads Machinery Company on June 25 moved its general sales office from 821 Bulletin Building, Philadelphia, Pa., to Kennett Square, Pa. All municipal officials and contractors corresponding with the company after that date should address letters to Kennett Square, Pa.

New Truscon Branch Manager

B. E. Bowlus, formerly Branch Manager of the Toledo office of the Truscon Steel Company, Detroit, Mich., has been made a special representative of the Cash Sales Department at the Youngstown, Ohio, office. A. E. Schroeder has been appointed Branch Manager at Toledo to succeed Mr. Bowlus.

Bilge Pump Motors Flooded

The advantage in having top heads of vertical motors enclosed as used with the Yeomans Brothers bilge pumps and sewage ejectors was illustrated recently by an instance that occurred in connection with a Yeoman duplex bilge pump installed in a large New York bank.

The headroom above the pumps was about 6 feet, whereas the pumps were built for 8 feet deep pit. A 3 x 3-foot opening was made in the floor above the pumps to facilitate handling the equipment.

While the opening was being cut through the concrete floor, the motors and controls were covered by a thin muslin cloth to prevent dust and particles from falling into them. Directly above the installation was a sprinkler head. One night the masons failed to remove the cloth, and during this time it caught fire, presumably from the self-starters, and the heat opened the sprinkler head, discharging about 5,000 gallons of water on the motors and surrounding appliances.

Small and Large Machinery at Work

THE LITTLE NOVO CONTRACTORS' BILGE PUMP FIGURED PROMINENTLY ON THIS JOB IN UNWATERING THE EXCAVATION FOR THE FOUNDATION

A PACKARD TRUCK PULLING UP A STEEP GRADE FROM A BUILDING EXCAVATION

AN ERIE CRANE WITH CLAM-SHELL BUCKET LOADING A STANDARD TRUCK IN A DETROIT, MICH., FREIGHT YARD

THIS FEDERAL TRUCK GREATLY FACILITATED THE WORK OF THE CONTRACTORS IN LAYING A NEW BRICK PAVEMENT IN ANDOVER, MASS.

Surveys, Plans and Specifications in Road Building

Surveys

THE purpose of the survey is to secure the necessary data for determining and fixing the best location, to supply such data as may be needed in the preparation of the plans and estimates of costs, and, finally, to serve as a base on which the actual construction work is referenced. The cost of the survey will vary with conditions and the class and extent of the intended improvement. If the location of the improvement is not definitely fixed by natural or other conditions, one or more preliminary or reconnaissance surveys may be necessary in order to determine definitely the best and most economical location. The final survey should be accurate and permanent enough to serve as a basis for marking the exact location of the proposed improvement on the ground and also obtaining all necessary data for plotting the map and preparing profiles, estimates of quantities, drainage structures, etc. The survey notes should be so complete that nothing is left to be supplied from memory. It really requires considerable experience, judgment and forethought to be able in one trip to the field to secure all the data which will be required and useful later in the office designing room.

Plans

The plans usually consist of a map or plan of the road and as much of the contiguous territory as may be desirable, a profile and such cross-sections and other detail drawings as will show all dimensions of the proposed improvement. If bridges, culverts, retaining walls or other special structures are necessary, fully detailed drawings should be provided.

The scale to which the plans should be drawn will necessarily vary somewhat with conditions, character and extent of the improvement. For the map, scales of 100 to 500 feet to the inch are common, while for the profile 40 to 80 feet to the inch horizontal and 4 to 8 feet to the inch vertical are usually sufficient. The complete plans should be clear, concise and full of information, both for the constructing engineer and the contractor. The more fully all the various details can be shown on the plans, the less chance there will be for misunderstandings between the constructing engineer, or his inspectors, and the contractor. It is almost a universal experience that not one-half the difficulty is experienced in securing substantial compliance with any requirements clearly detailed in the plans that is incurred if the same requirements are only described, however clearly, in the specifications.

The layman is apt to belittle the value of the preliminary work done on the surveys, plans, etc., and become restive in his anxiety to "see the dirt fly." It is up to the engineer to let the public know more of the value of the saving resulting from careful preliminary studies. One hint will have to suffice here. In almost any mile of road, a careful study of the earth work alone hardly ever fails to disclose points where a reduction of two or three hundred cubic yards can be effected without any detriment, and sometimes even with improvement, to the layout as a whole. At normal prices elimination of this amount of earth work means a clear saving of from $100 to $250—surely an item worth while.

Specifications

The specifications should set forth in language so clear as to be impossible of more than one interpretation, the work to be done, the manner of doing it, and the character of the materials to be furnished. The specifications, together with the plans, form the basis on which the contractors bid, and after the contract is let, serve as a guide for both the contractor and the engineer in the further prosecution of the work. In how much detail the various operations are to be described will depend on local conditions, and, to some extent, the legal requirements. The tendency toward using the so-called standard specifications would be commendable providing road building had reached that much longed-for state known as "standardized." Road building, however, is in an active transitional period, and what we call standard to-day often has become bad practice by to-morrow. Hardly a month goes by that does not mark really

important steps in the development and use of means, methods or materials. Furthermore, at the present time conditions are so unsettled that a practice which was economical and efficient at the beginning of the job may be decidedly the reverse before the work is completed.

There is, therefore, a great need for more elasticity, especially as to means and methods, than is common in the standard specifications of to-day. More latitude should be given to the contractor in the ways and means of accomplishing the work, so as to take full advantage of his ability and inventive genius under the spur of increasing reward. If there is any inherent value in the method of doing the work by contract, why neutralize that value by forcing the contractor to do the work in every detail exactly as the engineer would do it under force account?

The specifications when completed should be examined, first, as a whole, and then as to each clause separately. There must be no conflicts or ambiguities, and nothing should be inserted which is not necessary. A good old rule, which, however, seems to be more frequently broken than kept, is: "Know what you want; ask only for it; and state your requirements so clearly that anyone can differentiate between what is specified and 'something else just as good,' but which is not what you want."

ACKNOWLEDGMENT.—Reprinted from "Modern Road Building and Maintenance," published by the Hercules Powder Company, Wilmington, Del.

Portable Rock Breakers

IF highways are to be built at a reasonable cost, road material must be produced on a businesslike basis. Economical crushing is impossible with a small portable outfit having only 150 to 200 square inches of feed area and an average output of barely 10 cubic yards per hour. A big crushing plant is necessary to produce crushed rock at low cost. The Smith Engineering Works, Milwaukee, Wis., has produced in a compact form a large unit of the Telsmith primary breaker, having a large feed area and unusual capacity. For instance, a No. 5 mounted Telsmith primary breaker has two feed openings, each 10 by 48 inches—over 900 square inches of feed area. It crushes 25 to 35 cubic yards per hour and requires only 30 to 35 horse-power. In spite of its large capacity, its feed level is only 6 feet 3 inches above the ground, and the complete equipment, including steel platform and channel frame folding elevator, weighs slightly under 15 tons.

This saving in weight and height is not accomplished by paring down material or close designing. With the shaft rigid, the eccentric inside the head, the frame shortens itself, and the reduction in weight follows inevitably. The crusher walls are made very thick, the ribbing is formidable, and the weight per inch of height is claimed to be greater than in any gyratory crusher. The 35 per cent economy in weight and height still remain as net gain, due to the substitution of a short pillar shaft instead of a long, weak lever shaft.

This primary breaker has a "parallel" pinch —a horizontal movement of the crushing cone, like the action of the eccentric strap on a steam engine. The head does not turn except for a slight "creep" when the bowl is empty. The crushing stroke is gyratory, but the gyration is as great at the top of the head as at the bottom. This long initial "bite" is of great value in gripping the big chunks, and particularly in crushing smooth gravel boulders. The Telsmith parallel pinch grips and breaks large, hard, polished "nigger-head" with less slippage or rocketing than almost any other crushing device. For the same reason, it will crush a bigger stone than other breakers of corresponding size. This is particularly important in small quarries, where considerable sledging is necessary under the most favorable conditions.

These primary breakers fit into the most modern method of road construction, enabling the contractor to handle larger contracts, which are now generally favored most by Federal, state and county units, and also by the contractor himself. In the old days the road builder was content with a small crushing unit having about 160 square inches of feed area and an average capacity of less than 10 cubic yards per day. He hand-sledged most of the rock down to crusher size, transported it to the crusher in small cars or carts, and fed the breaker by hand. In view of the stupendous plans for road development which are now accomplished facts, contractors cannot afford to continue old methods. Bigger crushers and more modern methods must be used to cut the cost of road material, or the good roads movement will be seriously handicapped by the contractor himself.

Fifteen Big Trucks Build Better Roads

SINCE the early spring of 1919 Bacon Brothers, highway and bridge contractors of Saginaw, Mich., have been using a Duplex 4-wheel-drive truck in sand and gravel haulage. Since the first truck was purchased, 14 additional trucks of the same type have been added to the fleet. Each is equipped with a 3-yard sand or gravel hand-dump body. The first five trucks purchased in the spring of 1919 have each done about 25,000 miles, with very nominal charges for repairs. This is not a bad record when it is considered that frequently these trucks are driven a hundred miles per day.

Some highway contractors using 3½-ton two-wheel-drive trucks in this section have in some instances been forced to delay construction work on their contracts for a while when their sand and gravel pits lay over roads deep in sand, until Bacon Brothers built hard-surfaced roads. It has always been the contention of William J. Bacon of this firm of highway contractors that motor trucks, to afford the greatest return to their owners, should be able in an emergency to perform under reasonably adverse conditions. In highway and bridge building the motor truck that will not perform under such circumstances is an expensive liability rather than an asset. If you must go another way round, and you cannot depend upon your trucks when needed, they should be put in the same class as fair-weather friends. When one considers the hard, grueling work done by the 15 Duplex trucks owned by this company, naturally one thinks of the cost of operation and repair, which might be supposed to be unusually high. Each of the trucks did about 10,000 miles last year, and averaged about 5 miles to the gallon of gasoline. In deep sand and loose gravel the lowest average on gasoline was 4 miles. As the tractive effort was decreased with better road conditions, the gasoline mileage was frequently increased to 7 miles per gallon, and from 100 miles per gallon of oil in heavy pulling to more than 200 miles on a gallon of oil over good roads.

At times in building water-bound macadam roads the hauls are short. The crushed stone is loaded either with portable loaders or from storage bins through chutes, so that the idle loading time is reduced to a minimum. This condition makes for economical haulage. During the last two years Bacon Brothers have built over 32 miles of highways in the state of Michigan. In all the various phases of highway and bridge development their equipment proved not only economical but decidedly dependable.

A complete repair shop is maintained on wheels, this outfit being mounted on a truck of lighter capacity that might be termed a portable service station. The superintendent of service and maintenance, A. J. Wright, with this portable equipment is prepared to take care of almost any emergency repairs that might arise, with the least possible delay. All the important units are carried completely assembled. This feature has saved many hours of valuable time and a good many hundreds of dollars. Each driver has positive instructions in case of any trouble to go to the nearest telephone and get in touch with the maintenance superintendent. The service truck is immediately dispatched to the scene to make the necessary repairs. Each driver is required to turn in a card at the end of every day. A space is provided on the card to note any irregularity of performance, so that it will receive attention that day. At the end of each day every truck is inspected. Each mechanic is required to fill in an inspection card covering each truck for the day it is operated.

The drivers are paid only for the days they actually work. This serves to make each driver do his utmost to see that any slight repair or adjustment is attended to before it becomes serious. This system of complete daily inspection and the fact that every driver realizes it is to his own best interest to keep his truck operating each day in order to receive pay for six days per week, serve to put a double check on waste of time.

Each driver is given a schedule of daily operation. In addition to noting on his daily report card his arrival at the point of loading and the location on the road where he dumps his load material, the daily mechanical inspection will catch any attempt to open the governor. Sometimes a driver will open his governor and make his regular schedule at the points of loading and unloading. When the daily inspection discloses this practice the driver is called on the carpet. The second offense draws the pink slip. So completely is the general superintendent and traffic manager of the company, W. H. Campbell, sold on the much-abused and short-sighted policy of overloading, that he has frequently seriously considered fitting each truck with a loadometer, a mechanical device which rings a bell continuously when as much as a few pounds overload is put upon the truck.

Where Can I Buy Tractors?

If this question is in your mind, turn to the "WHERE TO PURCHASE" directory, in the front of the CONTRACTORS' & ENGINEERS' MONTHLY, and you will find your answer.

The Construction of the Jersey City Prize-Fight Arena

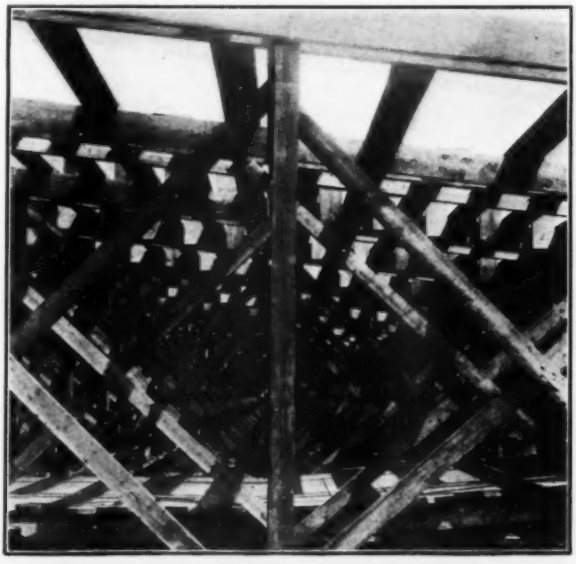
This Octagonal Structure Covers Over Eight Acres and Is a Model of Efficiency in Construction

THE construction of the wood arena for the Dempsey-Carpentier championship prize-fight, which was held on July 2, contains many features of interest to building contractors, large and small, who may be called upon at any time to build similar structures on the same or a smaller scale for local athletic events.

Inasmuch as the building contractors for the arena had only two months in which to prepare the site and actually complete the structure, the time element was of prime importance. In the preparation of the site, which was originally an ash-dump, about 60,000 cubic yards was removed before it was possible to begin actual building. The first steam shovel began operating on April 28, two days after the contractors were told to start work, and actual construction of the stadium began May 6. The stadium arena is octagonal in shape, being formed by eight triangles, each having a base of 256 feet with an altitude of 300 feet. The circumference of the arena is 34 feet above ground level.

The design of the stadium is simple, the essential parts being vertical supporting posts resting on timber sills, diagonal, lateral and longitudinal bracing, floor joists and flooring. The vertical supporting posts are of 6 x 6-inch timbers, with the exception of the outer four rows, which are 8 x 8-inch posts. These timbers are carried on 4 x 4-foot sills of 2 x 10- and 2 x 12-inch planks laid in two or three courses. Bracing is of ½ x 5-inch material. The longitudinal bracing consists of vertical posts at the sills and directly beneath the floor joists, and for the outer third of the distance from the center of the ring additional bracing is put in at approximate vertical intervals of 10 feet. The posts are braced laterally at the sills and by diagonals that connect each pair of posts.

The ring itself is 24 feet square and elevated about 4 feet. From the center of the ring out along the altitude of any triangle a distance of 138½ feet of the stadium is entirely floored over, accommodating about 12,000 seats and a row of boxes 10½ feet wide. Behind the boxes is a 3½-foot aisle, and then come successively bench-seat sections 24 feet, 56 feet, 36 feet and 30 feet in width, separated by 4-foot aisles. In these four sections the 2 x 12-inch floor planks are not laid continuous, but on 24-inch centers, and the bench seats, elevated about 14 inches, occupy these spaces between floor planks. Although not included in the original plans, 4 x 4-inch timbers are used to stiffen the floor, being laid midway be-



THE SILLS FOR TWO SECTIONS OF THE ARENA BEING SET

THE LATERAL BRACING AT THE APPROXIMATE CENTER OF THE STADIUM AND ENTRANCE RAMP

tween floor joists. The 2 x 12-inch floor joists are laid on either side of vertical posts and so arranged that the joints come on alternate posts.

The vertical posts are set on 10-foot centers in a direction perpendicular to the base of a triangular section and on 8-foot centers in a direction parallel to the base. The center lines of the sills, therefore, are perpendicular and parallel, respectively, to the base of a triangular section. Three pitches are found in the profile of the stadium, the breaks coming 51 feet, 190 feet and 250 feet from the center of the ring. The first 51 feet is level. The pitch in the first section is 1 foot in 10, in the second section 20 inches in 10 feet, and in the third 2 feet in 10 feet.

Triangular sections were erected independently and then joined. Lumber was cut on the job by three power-driven saws located at convenient points. All the sills for one, and at times two, sections were put in before any framing was done. Because of the uniformity of the size of timbers used, it was possible to carry on mass methods of cutting, framing and erecting. Lumber for main framing was scattered in place before any erecting began. An average of 450 men with a peak of 600, most of them carpenters and carpenter's helpers, were employed in building the structure.

When the contractors received the orders to start construction, they not only had to make available the site, but also had to bring to the site from nearby streets water for fire protection. Although a street ran through the site, the street carried no water-mains. Both an 8-inch and a 12-inch main were therefore laid, and hydrants were installed in the structure itself. The Coastwise Lumber Company, Brooklyn, N. Y., was given the contract for furnishing the lumber, having practically all the necessary lumber in stock. All this lumber was carried from Brooklyn to the stadium in motor trucks. A fleet of forty trucks was kept busy part of the time.

Entrance and exit ramps were provided in alternate triangular sections for ringside and box seats only. Ramps in series of three are placed in the center of other sections to care for these ringside and box seats. The entire structure cost approximately $250,000, of which about one-third was for lumber.

ACKNOWLEDGMENT:—*Illustrations by courtesy of Engineering News-Record.*

Who Makes Building Steel and Supplies?

Frequently you are confronted with the question of who makes a specific kind of equipment. By consulting the **"Where to Purchase"** directory beginning on page 3 of the CONTRACTORS' AND ENGINEERS' MONTHLY your query is quickly answered.

The General Contractor

By W. O. Winston
President, Associated General Contractors

THE general contractor, in common with the engineer, architect, mechanic and laborer, is a cog in a machine that makes for civilization and progress. He is both proud and happy to be in such company for such work. He is not concerned whether his cog be large or small; but whether it be large or whether it be small, he is concerned in having it so function that the master may say, "Well done, good and faithful cog."

In a nutshell, it is the rule and not the exception that the first concern of the general contractor is for his reputation—reputation for skill and integrity—realizing that on that, more than on anything else, depends not only his success but his happiness in business.

And now for a few minutes I shall speak about some things which are not germane to my text.

The construction game is not what it was when I sat in some forty-five years ago. The cards are different, the rules are different, and, speaking generally, the players are cleaner and squarer. In this time I have seen the steam shovel take the place of the pick and shovel, locomotives and cars of large capacity take the place of the wheelbarrow and the horse cart, and so on down the line. Through the instrumentality of these improved implements of construction, it is possible to do in three months now what would have taken twelve months then, and yet it will surprise many of you when I say that the unit cost of work has increased rather than decreased.

Fifty years ago, at least in the state of my birth, contracting was not considered to be a vocation of a gentleman. It was the work for the roughneck and overseer. But now, there as well as elsewhere, it is an honorable profession, second to none.

It is distinctly a creative and strenuous profession, and that is why it appeals so strongly as it does to men of vision, courage and guts.

ACKNOWLEDGMENT.—From an address delivered at the recent dinner of the executive board, Associated General Contractors, and guests, Washington, D. C.

Heavy Hauling Over Mountain Ranges

60,000 Tons Carried by Motor Trucks up Precipitous Grades

APPROXIMATELY 2,000,000 residents in that section of California south of Tulare County, almost two-thirds of the total population of the state, to-day enjoy the benefits of electric energy made possible through the use of the motor truck. Hundreds of millions of dollars are represented in the present-day hydro-electric enterprises of California, and the plans for their financing and construction are the result of over ten years' accumulative effort on the part of the organizations that devised and executed them.

Water-power is the first requisite of all this work, and the source of nearly all the water is back in the high Sierra Mountains, far removed from civilization and exceedingly difficult of access. In the earliest stages of the development all transportation connected with the construction was by horse and pack-mule. Gradually, after the trail became more travelled, roads were built, through almost endless toil, and motor trucks began forging their way from the nearest railroad point to the place where materials were needed.

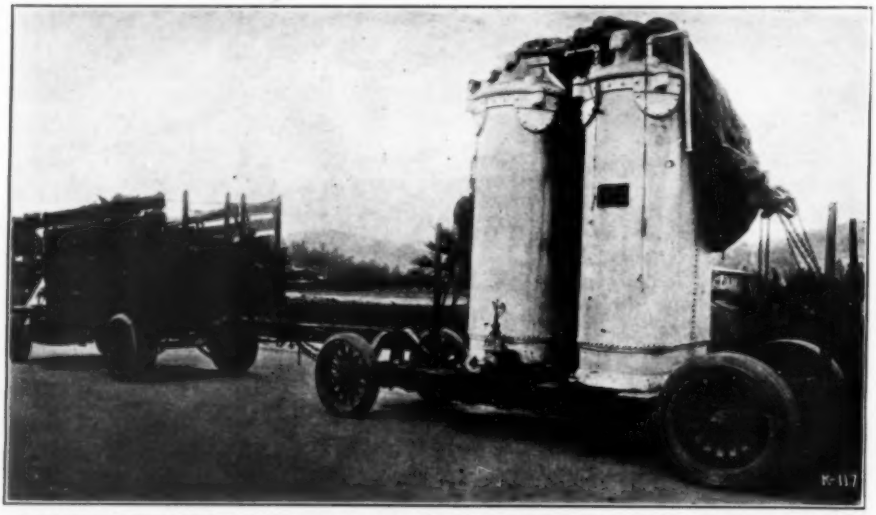
Of the several vast hydro-electric enterprises, the most remarkable motor-truck achievement has been identified with the Kern River No. 3 project of the Southern California Edison Company. Sixty thousand tons of materials, ranging in weight of individual pieces from a few ounces to 35 tons, have been transported by motor truck a distance of 50 miles, crossing 3 mountain ridges on a road having an average gradient of 5.9 per cent, with innumerable pitches as steep as 17 per cent. And all of this was accomplished in a period of 18 months.

The preliminary work in connection with the transportation end of the project necessitated the building of a garage, a camp,

warehouses, unloading platforms and the usual equipment, at Caliente, the nearest railroad point to the scene of the project. Eighteen miles of private road were built by the company, and a substantial sum was spent in maintaining a county road over which the trucks were operated. Ninety-four motor trucks of various makes were used in the work. The Edison Company owned and operated 37 units of Mack motor equipment.

Building the power-house and necessary adjuncts 50 miles from the base of supplies was no small achievement in itself. Yet in addition to this, a diversion type dam was built 14 miles by road above the power-house site, and 12 miles of tunnels, driven through solid rock, were constructed to convey the water from the dam to the power-house. Thousands of tons of cement went into this huge construction, and all of it was carried by motor truck over the mountain roads.

There were 2,800 men housed in 12 camps, and every foot of lumber used in building these camps, as well as every item of food and sustenance required by the men, had to make that 50-mile trip by motor truck. During the progress of the work, 20 miles of railroad were built, over which cars were operated mainly for hauling débris from the tunnels to the dumps. But this was an extraordinary railroad, inasmuch as the 40 miles of 20-foot rails and the thousands of ties were all hauled on motor trucks. In this connection it might be asked why the company did not build a complete private railroad over the entire distance for transportation. The cost of rights of way and construction through the mountains over such a distance was prohibitive. Furthermore, if trucks had not been used it would have been a task for horses and mules, and 8 years would have been consumed in doing the work that motor trucks accomplished in 18 months.



A MACK 5½-TON TRUCK CARRYING A 6-TON LOAD AND PULLING A TRAILER WITH A 19-TON LOAD OF ELECTRIC TRANSFORMERS

The heaviest single load that it was necessary to transport weighed approximately 35 tons. It was part of an electrical generator and was carried on a specially built trailer. It was moved by three Mack tractors, hooked tandem, pulling, and a fourth Mack pushing. The need for the pusher was not wholly for power, however. It furnished additional braking resistance on down grades, a decidedly important provision in moving loads of such weight.

Labor-Saving Equipment Reduces Costs on Cleveland Building Job

A CLEVELAND job which is worthy of attention, because of the concrete distribution methods used in its erection, is the new plant of the Cleveland Rubber Company, at West 117th Street and Berea Road, now being completed by the United States Engineering and Construction Company.

The building is one of a number that are being erected in Cleveland to accommodate the rapidly growing demands of the automobile industry in that city, and in its general outstanding features is similar to several other structures erected for the same purpose. It is 80 by 300 feet in size and is of steel frame construction, reinforced by concrete and containing concrete floors throughout. At present, the erection of only two stories is contemplated, but these are of such construction that three stories more can be added when required. The building as it is contains about 6,000 cubic yards of concrete.

The placing of the concrete was handled in a somewhat novel manner. It is the usual practice to "buggy" the concrete in constructing a steel frame building, because the steel frame interferes with the moving of concrete chuting. In this case, however, the tower was placed high enough so that an Insley quick-shift, counterweight chute plant could be swung over the top of the steel frame, and, with the tower placed at the center of one side of the building, the end of the counterweight chute covered the entire structure. The concrete was then hoisted, run through the chute to a point almost directly over where it was desired, and then dropped down through the steel frame by means of a short section of chute, directly into the forms. This permitted much more economical and speedier placing of concrete than would have been possible had buggies been used.

Materials are brought to the mixing plant in railroad cars and are unloaded into storage piles and bins by a Dobbie derrick. The derrick is operated by a two-drum engine with Dobbie holding-drum and Dake swinging engine.

The mixer used on the job is a one-half-yard tilting Smith machine, equipped with batch hopper. The mixer is a 1903 model and has been in use for 17 years.

The Proposed Crude Oil Tariff

IF the fight against the proposed tariff on crude oil which has been launched by the American Automobile Association, the Asphalt Association and individual oil companies and highway officials, is successful, the asphalt industry will be saved a serious blow and American taxpayers immense sums in the cost of improved roads and streets as well as in gasoline prices. The Ways and Means Committee of the House proposes an import duty of 35 cents a barrel on petroleum.

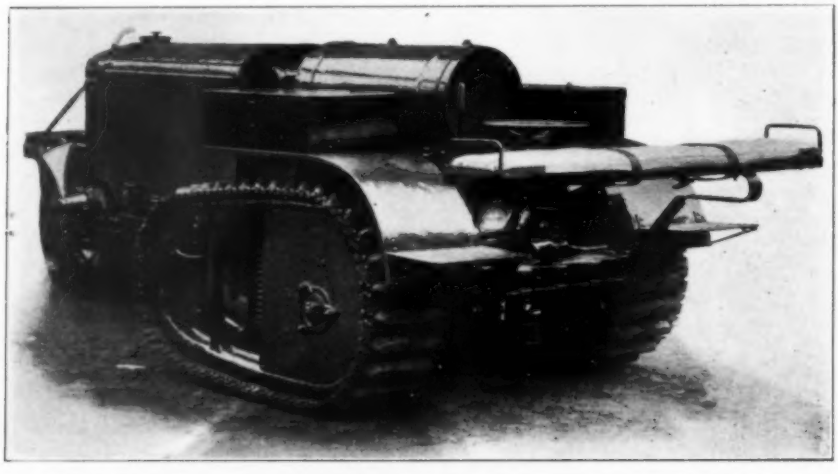
Mid-continent oil producers for some time have been urging Congress to place an import duty on Mexican crude oil. Action of this sort, especially in view of the proposed Mexican export tax on petroleum, will be certain to increase the cost of operating motor cars and trucks, as great quantities of Mexican oil are used in the manufacture of gasoline in this country.

In a similar way the proposed duty, it is contended, will vastly increase the cost of the refined asphalt and road oils manufactured from Mexican oil, and consequently will add to the cost of building bituminous roads and streets. While asphalt prices have been reduced considerably during the past year, high freight rates and costly labor still have their effect. To add to the cost now, according to highway officials, would seriously hamper the states, counties and municipalities in carrying out road-building programs that involve a constantly increasing use of the bituminous types of pavements. The proposed tariff on Mexican oil will not only result in increased cost of road-building, but will curtail the supply by about 50 per cent.

A Road-Building Tractor

TO take care of the demands of the road-building industry for a heavy-service tractor, the Yuba Manufacturing Company, 433 California Street, San Francisco, Calif., has developed a machine especially built for road building and maintenance. This Yuba road builder is a 25-40 machine, the grouser plates of which are of cast steel with a flat area in contact with the road, about 16 square inches for each tread. These treads are particularly resistant to wear and are so designed that they cannot mar the finest pavement. The entire width of the front wheel rests squarely on the road. The seat for the operator is of the artillery type, 14 inches wide and 6 feet long, mounted on two sets of leaf springs and fitted with a stuffed cushion. This provides for two persons besides the driver, or enables the driver to shift from side to side to watch the road or stakes ahead.

The treads are covered with wide, heavy fenders to protect the driver from dust and dirt, affording protection from accidental contact with moving treads, and support for the tool boxes. The Yuba tractor is particularly well known in the West, having first proved its worth in the agricultural field and then in the road-building field. In a test of a Yuba tractor pulling a grader between Dallas and Fort Worth, Texas, the dynamometer showed a starting pull of 6,100 pounds and between 5,000 and 5,500 pounds under steady operation. The outfit turns readily as sharply as the grader and can swing in its own length.



A TYPE OF TRACTOR RECENTLY DEVELOPED IN CALIFORNIA FOR ROAD BUILDING

Power-Loading and Low-Charging Concrete Mixers

IN the manufacture of Keystone mixers particular attention has been given to correct mechanical details and to making the operation as scientific as possible. The Gray Iron Foundry, Reading, Pa., manufacturer of this type of mixer, claims that it has established new records of efficiency, economy and durability.

This mixer is equipped with gravity flow, having an automatic water-measuring tank, which is positive in action and is claimed to be superior to tanks using the siphon principle for measuring. Absolute knowledge of the amount of water applied to each batch is assured by a device which controls the quantity of water discharged from the tank. The power-loader hoist is built to withstand the hard use to which machines of this type are put in building construction. It is readily adjusted, simple in construction, and operated by one lever which controls the hoist and the brake.

This company also manufactures concrete carts which are built so that the wheels carry the load and the man operating is only required to furnish the motive power, enabling him to move three times the load of a wheelbarrow with no greater muscular effort and without the back strain due to lifting.

"No more takin' it easy —the boss bought a **DANDIE MIXER** *—and it's goin' to keep us hustlin'—"*

THERE'S no time for loafing where a Dandie Light Mixer is on the job—any Dandie owner will tell you that. It's the last word in dependability—keeps the concrete coming and the wheelers on the jump.

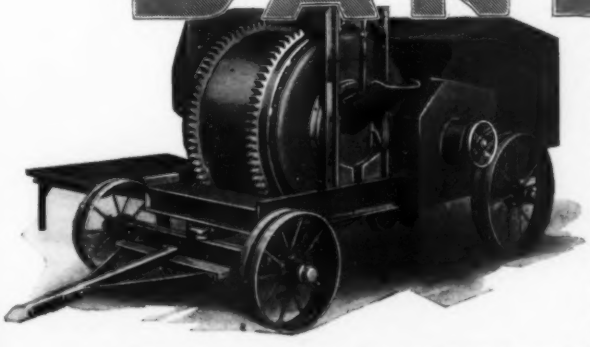
It's Koehring construction that accounts for it. The same never-failing performance that is well known to Koehring Heavy Duty Mixer users is built right into the Dandie—the famous re-mixing action—double gear drum drive—drum rollers, keyed to shaft—big bearing surfaces, etc.

Big volume production—automatic machinery—special Koehring processes of manufacture and numerous short-cut methods for economy production, have made it possible to offer the Dandie as the strongest light mixer at a ***light*** mixer price—the lowest price you can afford to pay and be assured of dependable performance.

KOEHRING COMPANY MILWAUKEE WISCONSIN

Send for the Koehring catalog—it tells all about it. Use the coupon below.

DANDIE



Koehring Company
Milwaukee, Wisconsin

Please send me DANDIE Catalog No. D 6.

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A New Type of Electrically-Welded Chain

THE increasing preference of buyers for electrically-welded chain has led the Columbus-McKinnon Chain Company, Columbus, Ohio, to develop an improvement on its earlier method of electric welding, which has proved very satisfactory. In manufacturing chain by this company's patented electric welding process a perfect fusion of the metal takes place, leaving a swell or flash of metal at the weld, which has characterized this product and which has come to be known as the "Swell-Weld." The extra material thus developed at the weld increases the strength approximately 25 per cent.

A SECTION OF "INSWELL" CHAIN, SHOWING THE NEW PATENTED ELECTRIC WELD

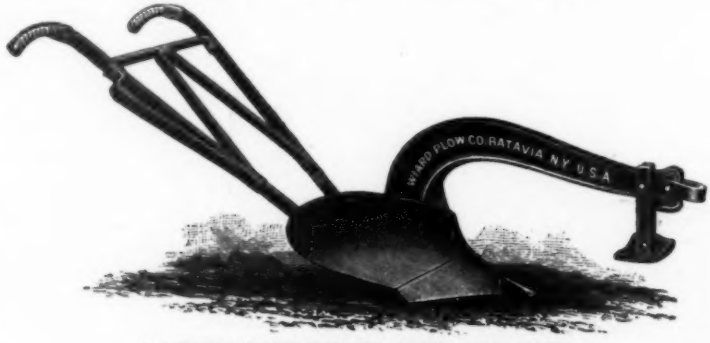
The new patented process forms a welded link which is smooth on the outside and without the swell as heretofore. All of the added material at the weld is retained by forcing it to the inside of the weld during the process of welding. In this manner it does not interfere with the action of the chain for any purpose but has the added strength of weld of about 25 per cent. Repeated tests to destruction have verified the additional strength at the weld and invariably break the stock and not the weld.

The product of this improvement is known as electrically-welded "Inswell" chain and is made in sizes from 3/16- to 3/4-inch, inclusive. This type of chain is especially adapted for all general uses, including steel loading, and for all chains to be fitted and used in pocket wheels or sheaves of any kind.

A Road Plow With Steel Beam

THE difficulties experienced by contractors in many instances in securing satisfactory road plows are claimed to have been overcome by the Wiard Plow Company, Batavia, N. Y., in its No. 64 road plow, which is equipped with a steel beam and weighs only 160 pounds. The beam is of crucible or electric steel, the handles are of steel, the moldboard of charcoal cast iron, and the land-side of cast iron. The plow is furnished either with a cast iron point or with a forged steel point, according to the desires of the contractor.

This plow is a new pattern of contractor's plow, somewhat lighter in weight than other plows manufactured by this company, and is adapted to use with two or more horses, or may be hauled by a tractor. Although the plow is light in weight, it has great strength, because of the use of cast crucible steel in the beam, which practically guarantees it against breakage. The plow has large capacity and very good turning qualities and will stick to the job in hard, stony or difficult plowing and not tend to work out quickly.



A STRONG LIGHT-WEIGHT STEEL ROAD PLOW

Save YOUR Roads

A dusty road is proof that the road is wearing away.

Standard Asphalt Road Oil properly applied prevents dust. It also saves the surface by binding it and making it water proof. By saving the surface you save the whole road.

The above illustration of a country road was taken immediately after an almost continuous rain fall of two weeks.

One application of

No. 4 STANDARD ASPHALT ROAD OIL

saved this road.

Our book, "Standard Road Oil," describing the different grades and proper methods of applying road oil to all types of roads, sent free on request.

STANDARD OIL COMPANY
(INDIANA)

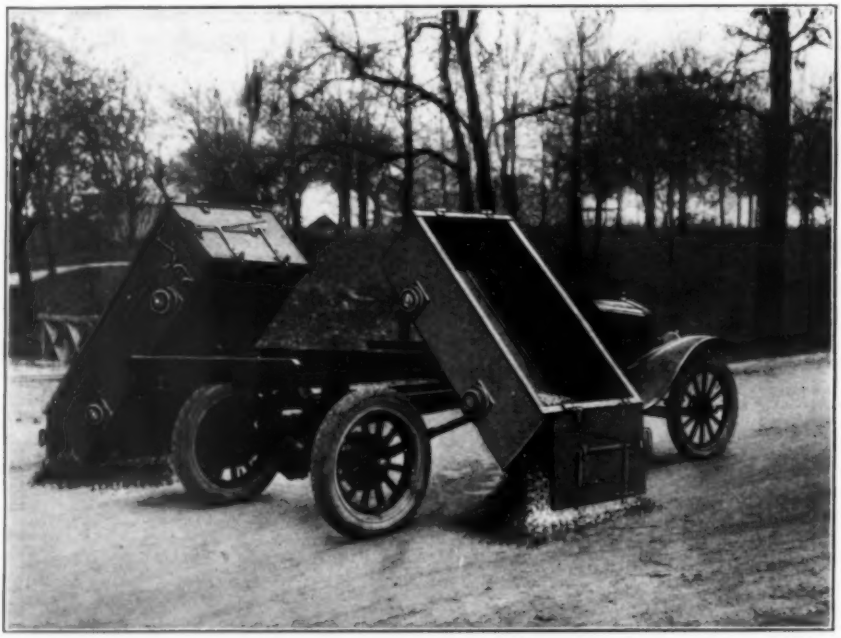
910 So. Michigan Ave. Chicago, Ill.

Pageant of Progress Exposition at Chicago's $5,000,000 Municipal Pier, July 30 to August 14

A New Side-Dump Body for Contractors' Trucks

A SIDE-DUMP body for light motor trucks has been designed by the Pechstein Iron Works, Keokuk, Iowa, with an idea of reducing the labor cost of the contractor and to keep aggregates clean. Various types of bodies for contractors' work have been tried, but have been found lacking in one or more points. This company has designed a side-dumping body, to hold enough material for a 3-sack batch mixer. The Gammon side-dump bodies are so placed on the chassis as to distribute the load evenly. This feature makes this type of body of great value to the contractor who wishes to reduce repairs to his truck and the delays incident to them. The overhang is very small. The dumping feature is one which appeals to those who haul bulk material. Both boxes can be dumped on the same side, or one can be dumped on the right and the other on the left, as shown in the accompanying illustration. Each can be operated from either side and independently of the other. The capacity of the two boxes is 1.4 yards level full, or by slightly rounding up the material, 1.5 yards. The two-box idea permits the user to regulate the size of the load according to the condition of the road, enabling him to continue mixing when others are forced to be idle by adverse weather or soft roads. The boxes are easily loaded by measuring hopper or by hand.

The balance of the box when dumping is well-maintained. A steel shaft is riveted to the center of each box, and two trunnions, fitted on the inside of the channel steel frame, hold the box in position. The four large wheels running on top of the channels facilitate the movement of the boxes into dumping position. Each box is held by a positive lock to the frame. This lock is operated from either side. Because of the balance and the gradual way in which the boxes come into dumping position, there are no undue or sudden strains on the truck chassis, and the material is dumped into a neat pile because of the closeness of the boxes to the ground, instead of being splashed all over the subgrade, as happens when the material is dropped from the height of the frame.



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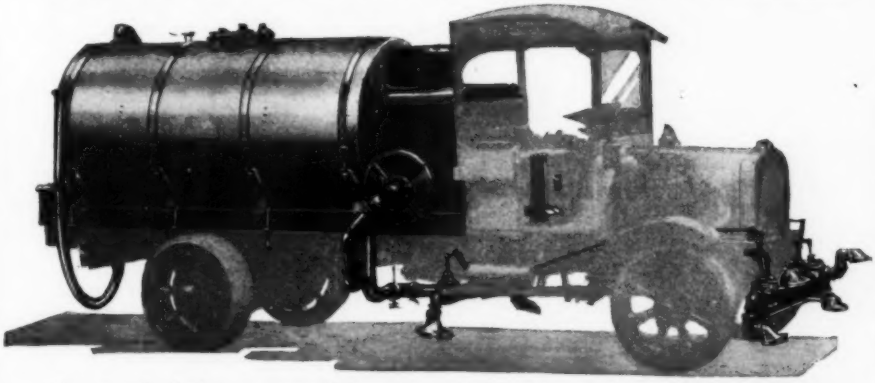

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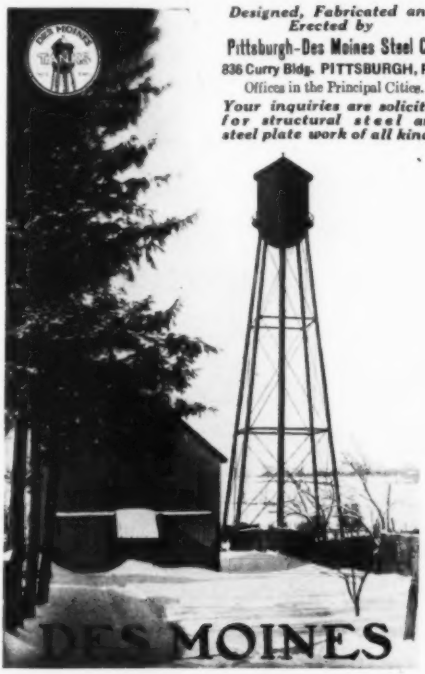

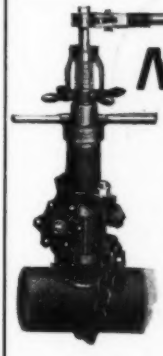

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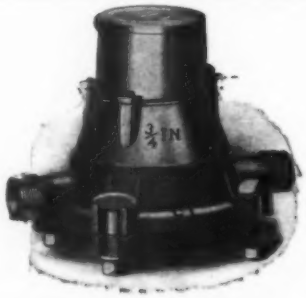

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INDEX TO ADVERTISERS

After referring to the "Where to Purchase" Section, on pages 3 to 37, if you will look up the advertisements as per index below, you will be able to secure further data (with illustrations in many cases) on the material or equipment relative to which you are seeking information.

Acme Road Machy. Co..... 8
Allis-Chalmers Mfg. Co..... 88
Alpha Portland Cement Co..... 85
American Chimney Co..... 96
American Well Works..... 88
Archer & Co. E. T..... 95
Austin-Western Road Mach'y Co. 28

Badger Meter Mfg. Co..... 92
Baker Mfg. Co..... 18
Banks & Craig..... 95
Barber Asphalt Paving Co..... 100
Barrett Company, The..... 84
Bay City Dredge Works..... 10
Best Tractor Co., C. L..... 85
Brooks Co., R. E..... 79
Brown & Sites Co..... 79
Bucyrus Co..... 30
Buffalo Meter Co..... 94
Buffalo-Springfield Roller Co..... 28
Builders Iron Foundry..... 92
Burch Plow Works Co..... 36
Busch-Sulzer Bros.-Diesel Eng.Co 90

Carey Co., Philip..... 16
Central Foundry Co..... 91
Cleveland Tractor Co..... 32
Conard & Buzby..... 96
Crane Co..... 89
Craven Co., Frank T..... 82
Cummings Machine Co..... 22
Curtiss-Willis Co., The..... 82

De Laval Steam Turbine Co..... 89
Delaware Clay Products Co..... 37
Denver Rock Drill Mfg. Co..... 82
Dewey Supply Co..... 79
Dow Chemical Co..... 84
Du Pont de Nemours & Co., E. I..84-90

East Jersey Pipe Co..... 86
Easton Car & Construction Co..... 20
Electric Railway Equipment Co. 97
Engineering News-Record..... 2
Equipment Corp. of Am..... 79
Equitable Asphalt Maint. Co..... 8

Fairbanks, Morse & Co..... 86
Fairfield Engineering Co..... 82
Federal Motor Truck Co..... 40
Ford Meter Box Co..... 94
Forsythe Bros..... 79
Fuller & McClintock..... 97

Gannett, Seelye & Fleming..... 95
General Electric Co..... 96
General Motors Truck Co..... 99
Glaeser, Frederick..... 95
Good Roads Machinery Co..... 24
Gray Iron Foundry Co..... 22
Grey Steel Products Co..... 81
Gulick-Henderson Co..... 95

Hansen, A. B..... 95
Hauck Mfg. Co..... 6
Heil Co., The..... 36
Heltzel Steel Form & Iron Co... 8
Hersey Manufacturing Co..... 94
Higgins, J. Wallace..... 95
Hill & Ferguson..... 95
Holt Manufacturing Co..... 83
Houston, J. C..... 82
Hyland Co., R. H..... 79

Indiana Air Pump Co..... 88
International Motor Co..... 85

Jaeger Machine Co..... 8
Johnson Co., Inc., Geo. A..... 95

Kelly-Springfield Tire Co..... 85
King Mfg. Co..... 96
King, Philip T..... 82
Kinney Mfg. Co..... 26
Knickerbocker Co., The..... 18
Koehring Co..... 75
Koppel Indus. Car & Equip. Co. 20

Lane Co., T. J..... 82
Lea-Courtenay Co..... 88
Littleford Bros..... 82
Lynchburg Foundry Co..... 90

Marion Steam Shovel Co..... 30
Mathieson Alkali Wks., Inc., The 36
McClure Green Engr. Co..... 95
McGraw-Hill Co..... 2
McKiernan-Terry Drill Co..... 12
Mueller Mfg. Co., H..... 89
Municipal Supply Co..... 83

National Hoisting Engine Co.... 18
National Meter Co..... 92
National Steel Fabric Co..... 84
Nat'l Water Main Cleaning Co. 87
Neptune Meter Co..... 93
Newport Culvert Co..... 4
Nordberg Manufacturing Co.... 88
Northern Fire Apparatus Co.... 84
Norwood Engineering Co..... 90
Novo Engine Co..... 10

Otterson Auto Eductor Co..... 86
Owen Bucket Co..... 6

Pacific Flush-Tank Co..... 86
Pawling & Harnischfeger Co.... 14
Payne Dean Limited..... 89
Pease Laboratories, Inc..... 95
Pennsylvania Salt Mfg. Co..... 90
Pioneer Asphalt Co..... 22
Pitometer Co..... 86
Pittsburgh-Des Moines Steel Co. 89
Pittsburgh Filter & Eng. Co.... 94
Pittsburgh Meter Co..... 92
Pollock, C. D..... 95
Porter Co., H. K..... 20

Ransome Concrete Machy. Co.. 38
Robinson, Geo. L..... 95
Rochester Can Co..... 90
Rossiter Co., Edgar A..... 96

Simplex Wire & Cable Co..... 92
Smith & Co., C. E..... 95
Smith Mfg. Co., A. P..... 86
Standard Oil Co. of Indiana..... 77
Standard Scale & Supply Co.... 37

Terry & Tench Co., The..... 96
Texas Company, The..... 1
Thew Shovel Co..... 30
Thomson Meter Co..... 94
Truscon Steel Co..... 18
Turbine Sewer Mch. Co..... 86

Union Metal Mfg. Co..... 97
Union Water Meter Co..... 94
Universal Audit Co..... 95
Universal Road Machinery Co.. 82

Wallace & Tiernan Co., Inc..... 34
Waring-Underwood Co..... 8
Warren Bros. Co..... 85
Westinghouse Companies Illuminating Engineering Bureau... 97
Western Wood Pipe Pub. Bureau.. 87
Weiss, B. M..... 81
White Co., The..... 83
White, Gilbert C..... 95
Winther Motor Truck Co..... 80

Manufacturers who advertise in alternate issues may not appear in the above INDEX, but are carried in bold face type in the WHERE TO PURCHASE section at the front of this magazine. Readers wishing catalogs or further information regarding the products of these manufacturers should write to the CATALOG DEPARTMENT, CONTRACTORS' & ENGINEERS' MONTHLY, TRIBUNE BUILDING, NEW YORK CITY.

90
10

86
6

86
14
89
95
90
22
86
89
94
92
95
20

38
95
90
96

92
95
86
77
37

96
1
30
94
18
86

97
94
95
82

34
8
85

97
87
81
83
95
80

GMC

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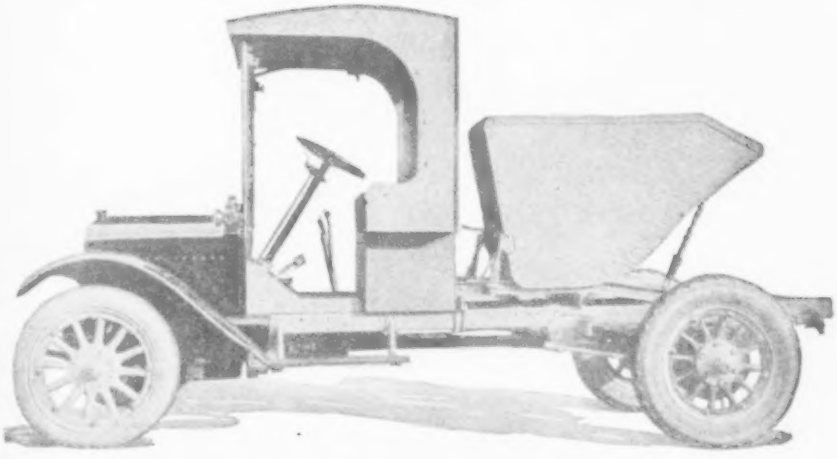

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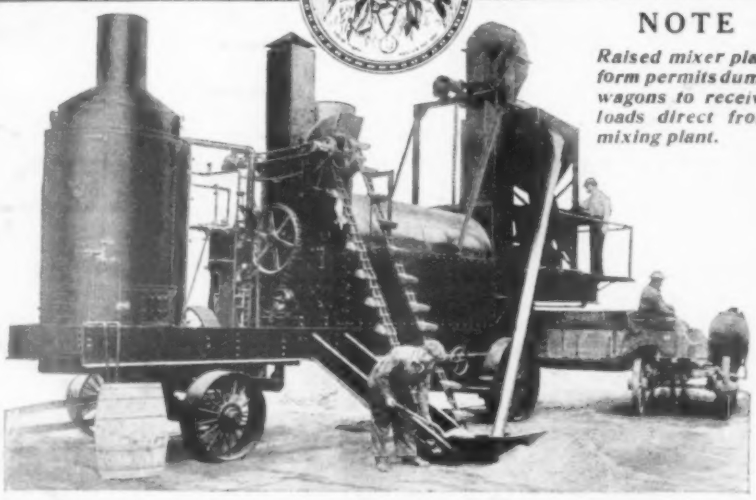

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